# Orbit

No. 17

January/February 1984
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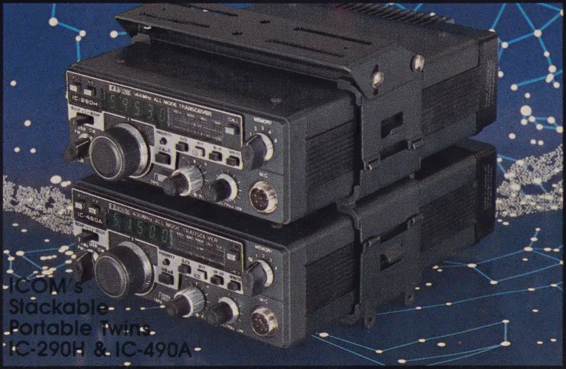
Journal of the Radio Amateur Space Program

Published by AMSAT — The Radio Amateur Satellite Corporation

# Star Performers!

## ICOM's VHF/UHF Pairs for Satellite Communications



ICOM's Stackable Portable Twins IC-290H & IC-490A

**Oscar 10...Are you ready? Join the future of amateur satellite communications with ICOM VHF and UHF transceivers. Read why ICOM is *...Simply the Best* for satellite communications.**

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This new series of VHF/UHF base stations offers a combination of features and flexibility found in no other transceivers anywhere. For receiving MODE J down-link, the IC-471A features a less than 0.5 microvolt for 10dB quieting SSB receiver plus an optional mast mounted GaAs FET preamplifier with a 15dB gain.

Thirty-two tunable memories keep the IC-471A ready to go on frequency and to monitor the beacon frequencies. A good noise blanker plus all-mode squelch make listening a real pleasure. 10Hz variable speed tuning, which automatically shifts to 100Hz when needed, and a low-noise PLL that locks to 10Hz makes the frequency resolution of the ICOM Twins second to none. For MODE B use, the IC-471A features a 10W SSB transmitter with variable power control.

The same basic features of the IC-471A apply to the IC-271A and an optional internal pre-amplifier with front panel switch is available. The IC-271A transmitter features 25W of transmitter power.

The IC-471A and the IC-271A both have options for computer interfacing. The ICOM BUS is brought out through an optional interface to the back of the radio. From this point, it may be routed to the ICOM computer interface terminal, mounted in a matching box, that will convert the ICOM BUS to RS232C standard. Allowing computer control of both transceiver units, this capability, plus the antenna-tracking programs available for Oscar 10, will make the IC-271A and 471A Twins the ultimate for computer control of your satellite operations.

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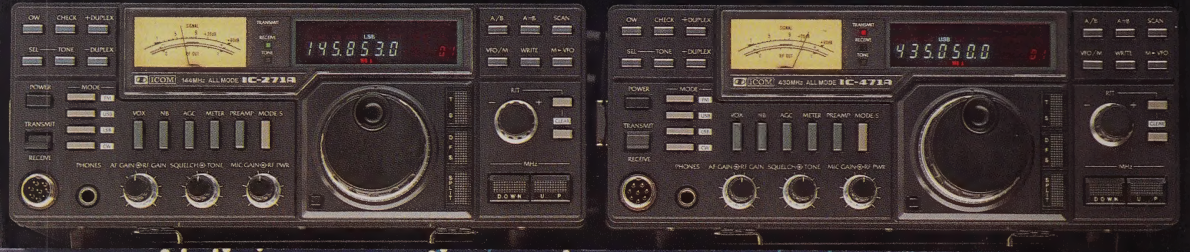

**IC-271A VHF Multimode**
**2 Meter / 25 Watts**

**IC-471A UHF Multimode**
**430 — 450 MHz / 10 Watts**

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All stated specifications are approximate and subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations limiting spurious emissions.

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**Volume 5 Number 1**

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# Ellipsis...

### An Editorial by Harold Winard, KB2M

## Florida Memories

Birds swoop gracefully around the Vehicle Assembly Building, catching thermals and occasionally joining their comrades perched high above the central Florida shore. The building, known better to those who work there as the VAB, houses America's greatest and most powerful rockets just prior to their launch from one of the many pads that dot the sandy shoreline. Man's oldest vision of flight, the bird, has found a home sitting on top of a monument to the greatest and most challenging adventure above the earth's surface - space.

Last November's visit to Cape Canaveral for the launch of STS-9 and Owen Garriott's ham-in-space mission wasn't my first trip to Cape Canaveral but I had never made it past the guardhouse before. On one very warm summer's day in 1965 my father and I drove to the Cape to see America's second manned space effort — Gemini — take another step forward. The weather became a factor that day when clouds rolled in to obscure the view. Perfect visibility was an absolute necessity for many launches in those days and without it, that August day, there was simply not going to be a liftoff.

As we waited along the beach, in the company of thousands of vacationers, I peered off in the distance, hoping to be able to catch a glimpse of the rocket, or perhaps the Gemini capsule itself. It was a long way across the water from the south-gate guardhouse to the launch pad and the best I could hope for was a chance to see the rocket as it climbed above the gantry and into full view.

I padded along the road up to the guardhouse in search of something cool to drink. Unlike our temporary neighbors along the roadway, we had not brought anything with us to drink, an almost critical mistake for Florida in August. The guardhouse was closed but I caught a familiar sight — a red Coca-Cola vending machine. I savored the taste of a frosty cold bottle of Coke and dug into my pocket for change, perhaps 30 cents or so would have been sufficient for a couple of bottles.

It was broken! Not only that but the machine was a relic...something Jack Lemon must have used to acquire his bottle of Coke for "Mr. Roberts." Imagine! It was 1965 and I was in front of a Coke machine, a 1940s Coke machine...at Cape Canaveral...and it was broken to boot. With all those engineers clustered in one spot how could a single Coke machine be broken? I never discovered the answer to that one. The weather turned sour, the launch was scrubbed, and my father and I headed north.

The Cape, more modern now, is no longer the proving ground it used to be. In fact, launches are almost routine and the crowds don't turn out in the great numbers they once did. In fact, for many the thrill simply isn't there. Veteran space afficianados still come for the launches and vacationers are still in abundance in Florida, but for many, space travel is not the piece of history-in-the-making that it once was.

There's a big visitors' building at the Kennedy Spaceflight Center with a large well-stocked cafeteria, complete with Coke. They show movies to the tourists there and young children thrill to tales of daring as they watch film clips of Gemini astronauts blasting off into space.

Space travelers now ride into space in coveralls and not the pressure suits of the early days. Scientists go into space too, not just pilots, and talk is that poets, philosophers, artists, and even newsmen are not far behind. Appearances are different but have the basics changed too? Does the heart quicken and tension build when the countdown closes on zero? Do others marvel at the mighty engines that drive massive spaceships above the earth's atmosphere?

Cape Canaveral has changed a bit but for some it still holds a unique fascination. The thrill of the past there blends with the challenge of the future. Despite the many years that have gone by since the early days of the U.S. space program even space-launch veterans must feel some excitement when the big ones lift off.

# Low-Cost Boost for Satellite Antennas

## By Allen Brinckerhoff, WB5PMR

*Low on cash but high on Satellites? A simple antenna extender improves station performance without draining your equipment budget.*

Less than $10 in parts and some easy construction buys a considerable increase in satellite-station performance where it counts — in the antenna system. After depleting my available equipment money on a brand new Yaesu FT-726R vhf/uhf transceiver, I was forced to consider an alternative to the purchase of new gear. The result was the installation of additional elements to my KLM antennas for a total boost in station performance by about 6 dB!

My antenna system consisted of a KLM 2M-14C for 2 meters and a 435-18C for the 435-MHz uplink. To add four elements to each antenna (two in each plane), I assembled the following shopping list before heading for the local hardware store:

**2M-14C**

5 ft. of 1¼-in. wooden dowel
142 in. of #6 copper wire
RTV silicon
Fiberglass strapping tape
Clear polyurethane varnish

**435-18C**

3 ft. of 7/8-in. wooden dowel
46 in. of #6 copper wire
RTV silicon
Clear polyurethane varnish

### Building the 2-meter Elements

The first step in building the extension for the 2-meter antenna is construction of a shim using the fiberglass strapping tape. That is necessary because the inner diameter of the antenna's aluminum boom is 1-3/8 in. while the outer diameter of the dowel is 1¼ in. The tape is simply layered around the dowel until it makes the dowel fit tightly into the boom. As shown in Fig. 1, two shims were used: one located at the end of the dowel and the other about 5 to 6 in. forward of the first.

The front vertical element of the antenna must be temporarily removed when the new wooden boom is inserted into the end of the aluminum boom. Using the front-element hole in the aluminum boom as a guide, drill a hole through the wooden dowel that will be large enough

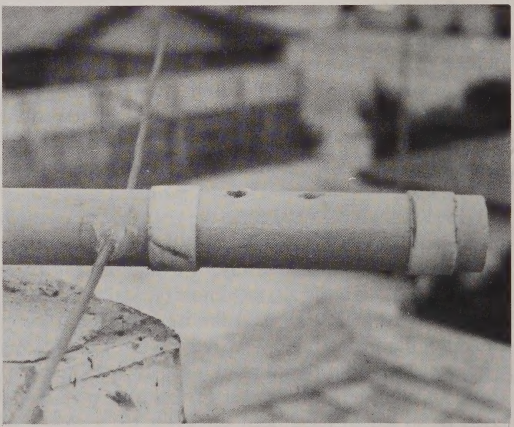


**Fig. 1 — Two shims help secure the wooden dowel inside the original antenna's aluminum boom.**

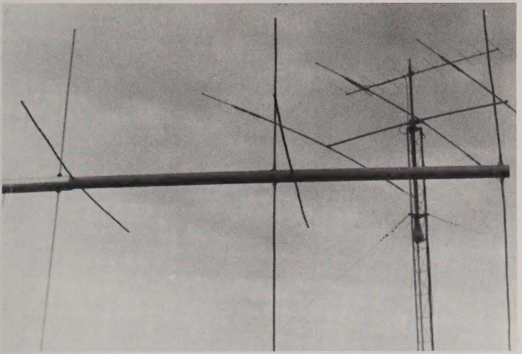


**Fig. 2 — A hole must be drilled through the wooden dowel to accommodate the antenna's original front director.**

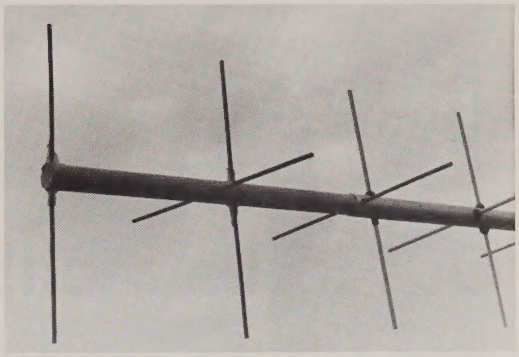


**Fig. 3 — Elements on the completed 435-MHz extender are secured with glue, sealed with RTV silicon, and weatherproofed with clear polyurethane varnish.**

to allow the vertical element's insulator to pass through both the aluminum boom and the dowel extension. That will secure the wooden boom in place. (See Fig. 2).

The two vertical elements must be mounted 1 ft. 10-1/8 in. and 3 ft. 8¼ in. forward of the original front vertical director. Drill vertical holes in the wooden dowel large enough to accommodate the #6 copper-wire elements, which should be 35-3/8 in. long. Repeat the procedure for the horizontal elements using the same spacing as above, however make measurements from the front horizontal director.

Insert the elements through the wooden dowel and secure them using epoxy or one of the fast-setting cyanoacrylic gules, such as Crazy Glue. Seal the area on the wooden boom around the elements with some RTV silicone sealant. Finally spray the entire assembly with clear polyurethane spray to protect it from the elements (weather, that is).

### Onto the 435-MHz Antenna

Construction of the 435-MHz antenna extender is similar to the 2-meter array with a few exceptions. Because the inner diameter of the aluminum boom and the outer diameter of the wooden dowel are the same, there is no need to build shims. The two booms will fit snugly.

The spacing and the length of the elements are different, of course. The spacing is 7¾ in. between elements, which should each be 11¼ in. long. The builder will discover that 7¾ in. forward of the original antenna's horizontal element requires a hole through both the aluminum and wooden booms. Be certain that the new element is well insulated from the aluminum boom. I drilled that particular hole oversized and created an insulator by making a shim around the center of the new element with black PVC tape. The finished 435-MHz extender should look like that shown in Fig. 3.

### Assessing the Results

Although my testing techniques are not entirely scientific, they do show a noticeable improvement in antenna performance. Without help from a preamplifier, a receiver tuned to the AMSAT-OSCAR 10 general beacon signal at 145.810 MHz showed an increase from S1 to S3 with the antenna extender installed. With the preamp turned on, the S meter jumped to S9 plus 5 from a pre-extender S7. The extender has some effects on SWR — from 1 to 1.2 — but the slight increase is quite acceptable.

The 435-MHz antenna was also tested with and without the extra elements. Based on the perceived increase in downlink signal strength, it appears that the uplink signal was boosted by about one S unit. The SWR increased slightly from 1.4 to 1.6.

# Out to Launch!

## A Photo Essay by KB2M and KA9Q

*Some familiar, and not so familiar views of Cape Canaveral at Shuttle time.*

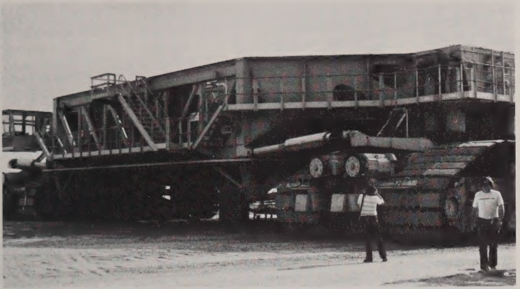
A landmark on the central Florida coast, the Vehicle Assemgly Building, or VAB, houses the Space Shuttle during its integration with the solid rocket boosters and external liquid fuel tank. Built to house a Saturn-class rocket, the VAB stands almost twice as high as the Shuttle.

No place on Earth conjures up the romance, the excitement, and the adventure of the 20th Century more than Cape Canaveral. That sandy point of land that juts out into the warm waters off the Florida coast has been the mecca for space enthusiasts for close to 30 years. Ever since the days when the U.S. found itself in a race for space with the Soviet Union, Americans by the millions have journeyed to the Cape to see other Americans brave the hazards of the unknown.

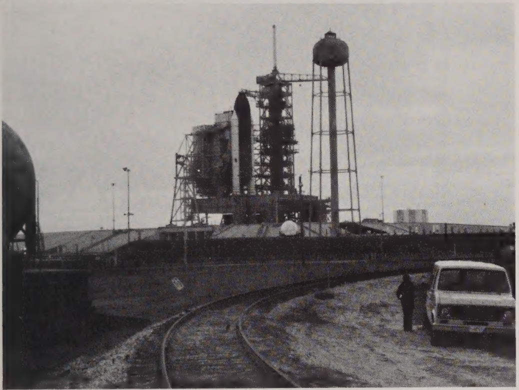
It is no longer novel to travel into space, in fact it's becoming quite routine. But the thrill is still there for those of us who still watch in awe as the ground slips beneath us and gradually pulls away when our jetliner leaves an airport. It's something man wasn't born to do but has done nevertheless...a true accomplishment of human ingenuity.

When astronaut Owen Garriott returned to space last November, *Orbit* Editor Harold Winard, KB2M, and AMSAT Assistant Vice President for Engineering, Phil Karn, KA9Q, were at Cape Canaveral to report that historic event. Dr. Garriott, W5LFL, brought a 2-meter handie-talkie into space and, during the following eight days, made contacts with hundreds of hams around the world. The following photo essay gives a glimpse at some of the not-often-seen events of the final hours before launch.

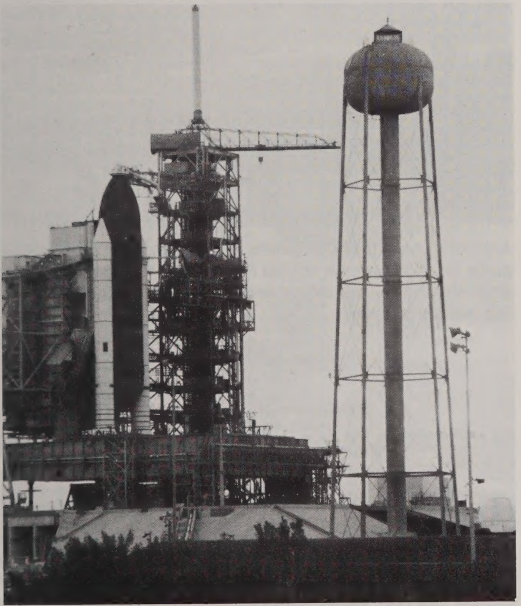
Phil, KA9Q, here shown practicing a modified form of civil disobedience, vowed to stop the American space program until AMSAT receives a free launch for a future OSCAR satellite. Phil now travels conveniently in a large manila envelope.

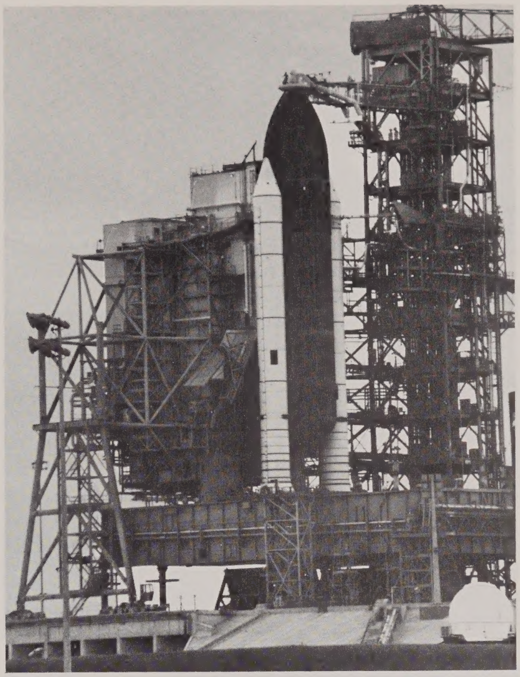


This massive crawler carries the Shuttle from the VAB to the launch site some 3 miles away.

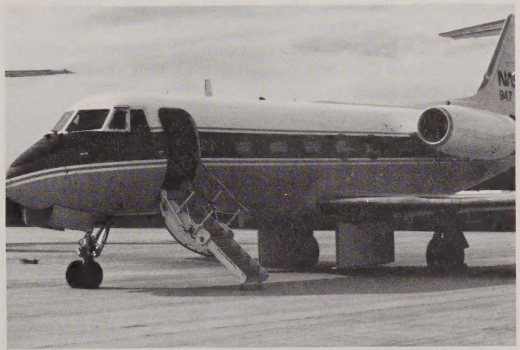


A trip to the launch site gives a good close-up view of Space Shuttle STS-9 prepared for liftoff. The spherical tank on the left contains the liquid hydrogen used to fuel the Orbiter's main engines. A similar tank, containing liquid oxygen, is located on the opposite side of the launch site.





The domed remote camera site (lower right) will be joined by several dozen tripod-based cameras prior to liftoff. The protected structure is located about 1000 ft. from the pad.

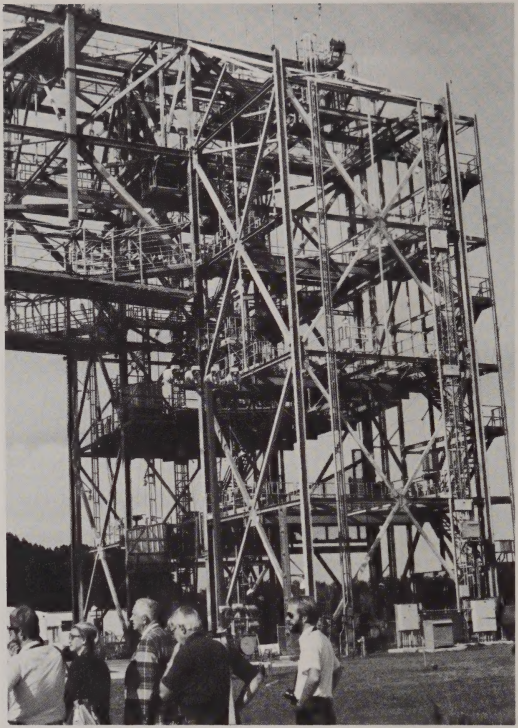


A seemingly ordinary twin-engine jet actually gives astronauts an opportunity to practice shuttle landings. The modified Gulfstream II (Note the air surfaces on the bottom.) simulates the flight characteristics of an actual Orbiter. When not used for practice, the plane ferries NASA personnel between the Johnson Spaceflight Center in Houston, Texas and Cape Canaveral.

< On the day prior to liftoff, the Oribter Columbia is still shrouded by its rotating service structure (RSS). The external fuel tank, less some 500 lbs. of unneeded paint, sports a rust-colored finish. The elevated deluge tank in the right foreground holds the water that cools the launch pad at the moment of engine ignition.

Harold, KB2M, rests his weary feet at Launch Complex 39B. That site, last used for the Skylab program, is being readied for Shuttle missions. The large open area is the flame trough that deflects the rocket's exhaust away from the launch vehicle. On a service road just 1000 ft. to the north are the twisted and pitted remains of a Stop sign, burned by the intense heat from the Saturn rocket's mighty engines.

Phil lends some perspective to the pipes that carry cooling water from the deluge tanks to the pad itself.



The mate/demate structure, installed at the Cape's landing strip, lifts an Orbiter off the back of a specially prepared 747 jet that returns the spacecraft to Florida for the next mission.

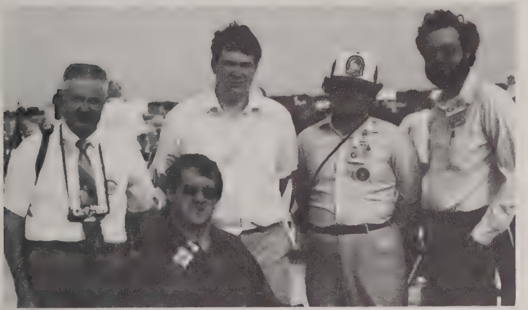
Astronauts keep their flying skills sharp by taking this T-38 chase plane for spins around central Florida. The twin-passenger jet goes aloft on launch day to keep tabs on the weather around the launch complex.

The media is part of the story too. Just about every brand of camera and lens are in evidence.

Reporters get a chance to rest or work at the press site's bleechers. AMSAT's KA9Q joined the throng. Can you spot him?

Not all attention focused on AMSAT celebrities. Here CBS reporter Morton Dean and ABC anchorwoman Lynn Scher listen intently to a NASA press briefing.

Meeting the press Florida-style is Shuttle administrator James Abrahamson (left). He's joined by an official from the European Space Agency (ESA).



Europeans will remember STS-9 as the first flight of the European Space Agency's Spacelab but radio amateurs around the world will always associate the mission with Dr. Garriott, the first ham-in-space. But real heros too are the members of the Motorola amateur radio group that designed and built the handie-talkie used by W5LFL for his historic contacts. From left to right are Tom McMullen, Jim Worsham, Harold Sanderson, and Bruce Burke. Seated is Ron Alexander.

Ignition! At T minus zero a puff of white smoke signals the start of the ninth Space Shuttle mission.

Seven seconds into the mission and STS-9 is on its way with full thrust from its main engines and two solid rocket motors.

Long gone but not forgotten, the Shuttle leaves a massive smoke cloud that lingers long after the Orbiter is on its way.

# OSCAR-10 Simulated Emergency Test

The National Communication System (NCS) has requested the participation of AMSAT in an OSCAR-10 Simulated Emergency Test during the first week of May. Test traffic will be passed via OSCAR-10 during one evening and on Saturday or Sunday of that week.

Those amateurs who would like to participate in the test are asked to contact AMSAT Headquarters as soon as possible. AMSAT regards the test as an important opportunity to demonstrate to key U.S. government representatives the viability of amateur satellite communications in times of disaster. It is hoped that a successful emergency test will pave the way for greater government support for future AMSAT launch opportunities.

AMSAT Headquarters can be contacted by phone at (301) 589-6062 or by writing to AMSAT, Post Office Box 27, Washington DC 20044.

The National Communications System was established in August 1963 by a Presidential memorandum and is a confederation of various Federal departments and agencies that pool their telecommunication assets to provide essential communications services for the government during situations ranging from day-to-day operations to national emergencies and international crises. Some of the principal assets of the NCS include the telecommunications networks of the Nuclear Regulatory Commission, the U.S. Postal Service, the Department of Commerce, the Department of Energy, the Department of Interior, the General Services Administration, the National Aeronautics and Space Administration, the Department of State, the Department of Transportation, the Department of the Treasury, the Department of Justice, the Federal Aviation Administration, the National Security Agency, and many others.

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## Comets

## AMS-2064 Update Computes Subsatellite Point

Using a set of supplemental instructions, available from AMSAT, the AMS-2064 orbital prediction program will display subsatellite-point data in addition to scheduling, tracking, and Doppler-shift information. The AMS-2064 program is tailored for the Commodore 64 or VIC-20 (with 16-k expander) computers.

The instructions, in listing form, were prepared by Bob McGwier, N4HY. They compute the latitude and longitude over which a satellite is positioned and are available, for a $5 donation, from: AMS-2064 Update, AMSAT, P.O. Box 27, Washington, DC 20044. The AMS-2064 program itself is available from the same source for $15. Make checks payable to "AMSAT."

### From KA9Q

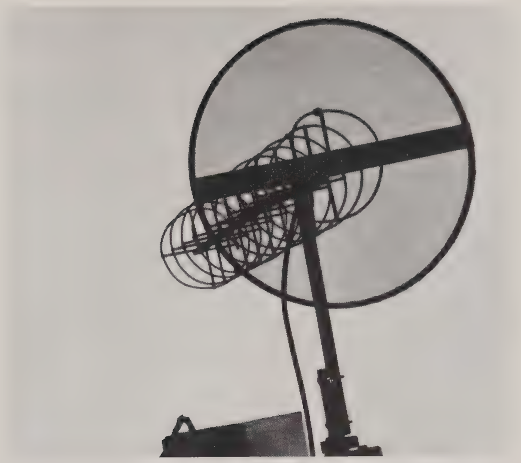
```
Satellite: uosat-b
Epoch time:      84061.79768519
   Thu Mar  1 19:08:40.000 1984 UTC
Element set:     prelaunch
Inclination:       98.2596 deg
RA of node:       124.2426 deg
Eccentricity:    0.0004100
Arg of perigee:   174.4207 deg
Mean anomaly:     226.7604 deg
Mean motion:   14.61025794 rev/day
Decay rate:              0 rev/day^2
Epoch rev:               0
Semi major axis:  7065.080 km
Anom period:     98.560888 min
Apogee:            690.030 km
Perigee:           684.236 km

Satellite: oscar-10
Catalog number: 14129
Epoch time:      84043.43656170
   Sun Feb 12 10:28:38.931 1984 UTC
Element set:     81
Inclination:       25.6986 deg
RA of node:       215.6553 deg
Eccentricity:    0.6089222
Arg of perigee:   245.0869 deg
Mean anomaly:      41.5600 deg
Mean motion:    2.05854046 rev/day
Decay rate:       -9.3e-07 rev/day^2
Epoch rev:             502
Semi major axis: 26105.753 km
Anom period:    699.524750 min
Apogee:          35627.288 km
Perigee:          3834.543 km
Beacon:           145.8100 mhz
```

# OSCAR-10 Joins ITU Conference

## By Colin Richards, 9M2CR

*Amateur Radio's high-flying satellite sports its stuff at the ITU World Communication seminar.*



A 10-turn "chopstick" helical antenna was used for the 435-MHz uplink signal.

Author (seated, right) demonstrates capabilities of an OSCAR-10 station to ITU Secretary-General Richard E. Butler during World Communications Year conference in Kuala Lumpur, Malaysia. Watching are 9M2AP and 9M2RS.

With the help of a group of enthusiastic Malaysian radio amateurs, the OSCAR-10 satellite made an impressive showing late last year at an important seminar sponsored by the International Telecommunications Union. The seminar, in Kuala Lumpur, Malaysia, was one of three held at different locations around the world to stress the importance of all forms of telecommunications for the social and economic development of Third World countries. The gatherings also helped highlight World Communications Year.

Amateur radio's involvement with the seminar centered around station 9M2CR, transplanted for the occasion from its normal location in Port Dickson some 100 km away. A small table on the topmost floor of the Kuala Lumpur Hilton, site of the conference, held a collection of amateur radio equipment connected to an antenna system set up on the hotel's roof.

The antennas, also part of 9M2CR, were controlled by azimuth and elevation rotors. Despite the bulk of the system, all was safely installed on the roof. And although everything went into place on the Sunday before the conference, the Sunday window — Orbit 357 — had long since closed by the time the gear was put together. Thus the station remained untested until the time it would be called upon to perform.

Not surprisingly, there was some anxiety when the station was switched on at 0100 UTC on Monday morning. Any doubts were dispelled when just two minutes later VK5ZTS in Adelaide responded with a 53 report...rather respectable for QRP-day operation.

The station used the called 9M2CR/WCY, in recognition of the conference, and was operated over a two-day period during breaks in the technical sessions. During that time, contacts were made with stations ranging from KL7GNG in Alaska to VK6KJ in the extreme southwest corner of Australia. Appropriately, JH7LGJ in Yagi Prefecture was also entered in the log.

The highlight of the operation was the visit of Richard E. Butler, the Secretary-General of the ITU. Mr. Butler, who donned a pair of headphones (see photo) to listen to OSCAR 10, was shown what radio amateurs, using limited resources and low power, could do with satellites.

The 435-MHz uplink antenna for the demonstration station (see photo) was a 10-turn "chopstick" helical type (see *Orbit* No. 5, January/February 1981, p.8). The antenna had been modified by using a "close-approach" first turn to yield an SWR of 1:1 for use with 50-Ω cable. Common RG-58 cable was used for the helix and was supported by a wooden frame. The reflector, an aluminum mosquito-mesh, was stretched across a bicycle wheel. The inexpensive antenna was in keeping with the demonstration's emphasis on low-cost technology for use in the Third World.

# An Innovation Trilogy
## Part I

*Innovation is an ideal. It is often claimed yet seldom realized.*

*Innovators are rare. They are often imitated, sought earnestly for counsel yet seldom emulated in substance.*

*AMSAT is blessed in having innovators and the fruits of their passion in embarassing abundance.*

*The Trilogy presented here is typical. Several of AMSAT's most gifted innovators lead us into the future.*

*In the case of the first article by G3YJO, the future is literally now. Martin Sweeting leads us through the new UoSAT-B satellite. This new amateur research satellite should be UoSAT-OSCAR 11 by the time you read this! Launch is scheduled for March 1 from Vandenberg Air Force Base, California.*

*Slightly further in the future a team from JAMSAT explains what to expect with the first OSCAR indigenous to Japan.*

*Finally, giving us a view of an elegant solution to a nagging problem, Jan King, W3GEY, explains how a unique fluid propulsion system (di-hydrogen oxide) may open future Space Shuttle missions to the kind of launch AMSAT needs for future amateur satellites.*

*We thought that by juxtaposing the thoughts of these innovators we might illuminate how rich we are in talent and motivation. Read now what we will see come to pass in years hence.*

*Vern "Rip" Riportella, WA2LQQ*
*Contributing Editor*

# The UoSAT-B Experimental Amateur Spacecraft

**By Dr. Martin Sweeting, G3YJO**
**University of Surrey**

An unexpected and imminent launch opportunity with NASA has arisen for a UoSAT-type spacecraft into a low, polar, sun-synchronous earth orbit. The premature demise of the LANDSAT-4 earth resources spacecraft launched in July 1982, has resulted in the replacement mission, originally scheduled for August 1985, being brought forward to March 1984. Launch opportunities for amateur payloads into useful orbits are becoming rare and hence it was felt that every effort should be made to respond positively to this challenge.

It must be realized, however, that to design, construct and test a spacecraft in six months is an extremely demanding activity and is accompanied by significant risks. There may well not be time to solve all the problems involved in meeting the following Mission Proposal and hence the experiment compliment or specifications may finally be somewhat different — we shall do our best to produce a stimulating and exciting spacecraft — but it is going to be TOUGH!

### Background

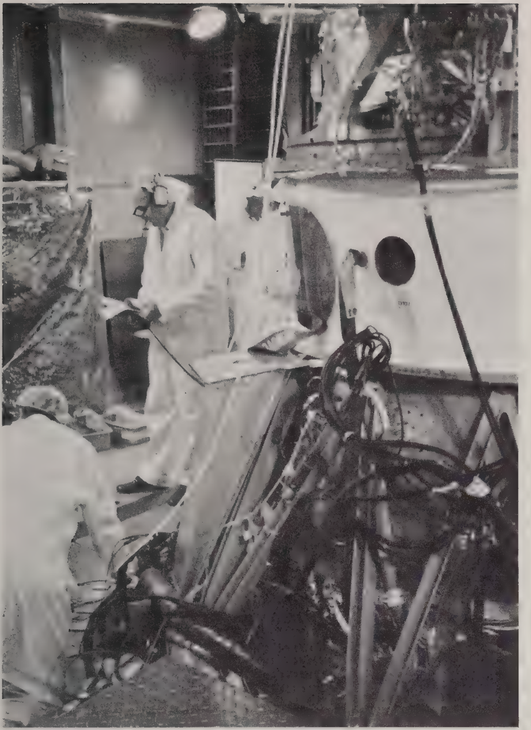
The UoSAT Spacecraft Group at the University of Surrey (UK), working with AMSAT, has been responsible for the UoSAT-1 spacecraft successfully launched with SME by DELTA in October 1981 into a 550 km, sun-synchronous, polar orbit carrying an array of educational, scientific and engineering experiments. The mission, while demanding, has been highly successful — particularly in stimulating interest in space activities among students, radio amateurs and computer enthusiasts, in addition to yielding valuable engineering experience.

The UoSAT-1 spacecraft is still operational after two years in earth orbit under the control of the Ground Command Station at Surrey. It is estimated that some 5,000 radio amateurs, students and computer enthusiasts are actively monitoring the spacecraft world-wide — many involved in complex spacecraft experiments.

### Introduction

The UoSAT Group became aware of the possibility of the early call-up of the LANDSAT-D' mission in late June 1983 and have explored the possibility of including a secondary payload on that mission for launch in March 1984. Informal discussions with the GSFC DELTA Project Office and MDAC (Long Beach) have indicated that it would be possible to include a slightly modified UoSAT structure within the dynamic constraints of the vehicle utilizing the now well-proven DELTA-AMSAT/UoSAT interface hardware.

The characteristics of the LANDSAT mission make it ideal for the experiments proposed for a second UoSAT (UoSAT-B), while maintaining the proven UoSAT/DELTA interface and the qualified UoSAT spacecraft structure which minimizes the effort and cost incurred by NASA.



This particular launch opportunity is uniquely valuable and timely as the major mission objectives involve scientific measurements in conjunction with other spacecraft missions scheduled for 1984 and several technology experiments (attitude, navigation and CMOS memory) that represent essential data for the success of mission planning for 1985-6. The value of these experiments will justify the effort necessary to prepare the spacecraft in so short a time scale — in view of which, the UoSAT-B spacecraft will be based on the same design philosophy as UoSAT-1.

Although there is a high degree of confidence, it is realized, however, that because of the short time scale this launch opportunity represents a high risk operation; both to UoSAT — in that scheduling constraints may prevent NASA support, and to NASA — in that there is a small but significant risk that the UoSAT-B spacecraft may not be fully prepared on time for integration with the launcher.

**Proposal**

A launch opportunity, as a secondary payload on the LANDSAT-D' mission (March 1984), has been approved by NASA for a UoSAT-B spacecraft on the same terms as the UoSAT-1 mission, namely that NASA undertake to provide a secondary launch at no cost, providing:

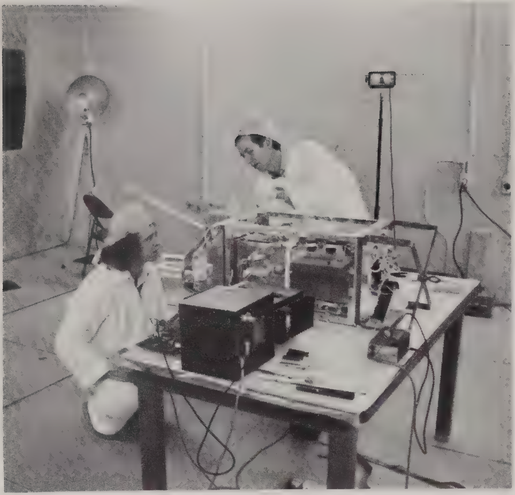
- UoSAT undertake to cover all spacecraft design, construction and testing costs.
- UoSAT satisfies NASA-DELTA-MDAC as to the intrinsic safety of the spacecraft.
- UoSAT is accepted as a secondary payload on a non-interference basis.
- All in-orbit spacecraft operating costs and responsibilities are undertaken by UoSAT.
- UoSAT undertake to minimize the complexity and cost to NASA of the secondary payload interface.

**Mission Objectives**

A 'UoSAT' class spacecraft is proposed as a secondary payload on the NASA LANDSAT-D' replacement mission in March 1984 with the following mission objectives, developing further those objectives already established by the successful UoSAT-1 mission:

a) Space Education

To stimulate a greater degree of interest in space science and engineering among radio amateurs, school-children, students, colleges and universities by active participation in a spacecraft project requiring only low cost ground equipment. The mission would exploit the foundations laid by the UoSAT-1 mission in this area while, in addition, providing a simple-to-use digital communications



transponder for use in the study of digital communications techniques. The highly successful 'synthesized speech' telemetry experiment carried on UoSAT-1 would be expanded, bringing direct access to space with the simplest and cheapest of ground stations.

b) Space Science

To provide professional and amateur scientists with a low earth orbit reference for magnetospheric studies to be carried out concurrently with the AMPTE & VIKING missions, while in addition supporting ground-based studies of the ionospheric D1, E & F regions currently being pursued with riometers and EISCAT. The spacecraft would also provide a readily available source of real-time and stored data concerning solar and geomagnetic activity to support radiowave propagation studies carried out both by professional scientists and radio amateurs. It is also proposed to study the density and trajectory of space dust particles.

c) Cost-effective Spacecraft Engineering

The mission would advance further the developments in cost-effective spacecraft engineering initiated by UoSAT-1 with a view to establishing a low-cost spacecraft system design for use in future STS-GAS launches and other secondary payload opportunities. The mission would investigate specifically the performance of computer hardware, software and memory devices; navigation, attitude control and stabilization techniques and the development of low-cost ground stations. In particular, the feasibility of a low-cost, flexible, simple-to-use store-and-forward digital communications package for global communications between simple ground stations, and of particular relevance to less developed countries, will be demonstrated and studies in conjunction with the Amateur Service.

**Mission Plan**

The UoSAT-B spacecraft will be prepared for launch by the UoSAT Satellite Group at the University of Surrey within the period August 1983 to February 1984. The spacecraft is intended for launch as a secondary payload by a DELTA 3914 vehicle accompanying the LANDSAT-D earth resources spacecraft.

The spacecraft will be controlled by a primary command ground station at Surrey, with a back up station in the USA operated by AMSAT. The expected mission lifetime is in excess of three years.

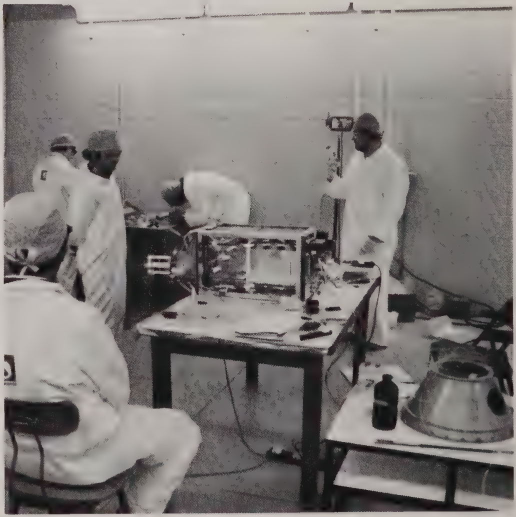
**Experiment Description**

The UoSAT-B spacecraft will carry five specific experimental packages in addition to the engineering systems experiments that will be described separately.

1) Particle-Wave Experiment

Three Geiger counters, similar to those flown on UoSAT-1, and a single electron spectrometer will be mounted on the spacecraft to serve as a near-earth reference for magnetospheric studies to be carried out concurrently with the AMPTE & VIKING spacecraft missions due for launch later in 1984, and for ground-based studies of the ionspheric D, E and F regions being pursued with riometers and EISCAT. Data will be available in either real-time or, for more detailed analysis, from stored measurements over both polar auroral regions to professional scientists and radio amateurs. A data-base of the measurements acquired over the life of the spacecraft will be established at Surrey in conjunction with the SERC and would be available to approved experimenters.

Specifically, the four detectors will monitor electron precipitation in the energy range 1-100 keV. Two of the Geiger counters will have threshold energies for electrons of 60 keV and be set at different angles in order to give a measure of the angular distribution of the precipitating electrons. The remaining Geiger counter will have a threshold energy for electrons of 100 KeV. The electron



spectrometer, similar to those flown on AMPTE-UKS, will yield both energy spectra and angular distribution of precipitated electrons of 1-25 keV so that a distribution function can be formed for these particles.

The electron detectors would, between them, provide an invaluable measure of the state of activity in the magnetosphere. This would include the degree of acceleration currently prevailing on auroral-zone magnetic field lines at the local time when the acceleration is greatest. It would also allow the latitude boundary between 'open' and 'closed' field lines to be located, and the rates of input of energy to the different regions of the ionosphere.

The modulations imparted on particles, as a result of wave-particle interactions in the magnetophere on auroral field lines, will be observed by a Particle Correlator Experiment. The measurements will identify wave-modes responsible for accelerating electrons into the auroral beam and will also identify wave-modes which limit the further growth of the auroral beam. These measurements will be achieved by one-bit and multi-bit correlations performed on the fast detection pulses taken from the electron spectrometer stepping through the auroral particle distribution function. A two-dimensional electron energy (velocity) versus frequency image of the particle modulations can then be obtained. Wave-modes will be identified by this dispersion diagram and those parts of the distribution function exchanging energy with waves will be identified directly.

2) Earth Imaging Experiment

The Imaging Experiment carried by UoSAT-1 generated a great deal of widespread interest and stimulated many varied studies concerned with low-cost data reception, demodulation, image processing and display. An improved version of the charge-coupled-device imaging experiment to be flown on UoSAT-B will develop further this programme aimed towards low-cost earth-imaging facilities both in space and on the ground. Short time exposures of earth will be gathered by the imager, stored within an on-board memory and transmitted down to very low-cost ground stations using easily received and demodulated transmission formats. The images of earth received can then be used for meteorological, teaching or scientific purposes by an extremely wide audience at low-cost. The image data can be transmitted by the spacecraft either immediately, repeatedly or at a later time upon ground command.

A specific application of the Earth Imaging Experiment will be to broaden the base of the near-earth magnetospheric studies by recording the luminosity of the aurora, and thereby a measure of electron precipitation, over a region extending for approx. 800 km on both sides of the satellite ground track. The intensity and structure of aurora over the crucial range of local times (2000-2300 hrs.) will be particularly valuable in assessing the state of magnetospheric activity.

3) Synthesised Speech Experiment

The 'Digitalker' synthesised speech telemetry experiment on UoSAT-1 has been extremely successful — not only with schools and radio amateurs, but also as a valuable operational facility! A second experiment with an expanded vocabulary more suited to spacecraft telemetry and news bulletins will be included on UoSAT-B to develop this unique experiment further. An extremely simple and inexpensive hand-held VHF/FM receiver using a whip or helical antenna is required to receive 'spoken' telemetry and experiment data direct from the spacecraft without the need for any decoding or display devices. This experiment brings 'live' space science and engineering to the lowest level of ground station requirements suited ideally to students and less developed countries.

4) Packet Communications Experiment

A store-and-forward digital communications experiment using packet transmission techniques will be included on UoSAT-B to demonstrate the feasibility of, and to study the characteristics of a global thin-route communications network based on simple, low-cost radio amateur stations. The Experiment will possess a 96k-byte CMOS random-access memory on board the spacecraft under computer control which will retain data and communications relayed to the spacecraft from a large number of ground stations using packet communications techniques complete with a hierarchy of 'addresses'. Each radio amateur station will be able to load data/messages into the Experiment and collect any data/messages previously deposited there for him using simple 300 or 1200 bps afsk fm techniques with low transmit power and relatively simple receiving facilities at UHF/VHF. These transmission links have already been successfully demonstrated in principle by UoSAT-1.

The experiment on UoSAT-B will also provide essential flight qualification and experience concerning the performance of both the CMOS RAM devices (two types from two different manufacturers) and a CMOS NSC800 microprocessor in a long duration, low-earth orbit environment. The results from these experiments will be invaluable in the planning and design of a future mission aimed at providing a comprehensive packet communications spacecraft.

5) Space Dust Experiment

A piezo-electric Impact Sensor will be mounted on UoSAT-B to detect and measure the rate of occurrence of space dust and micrometeorites in low earth orbit.

**Spacecraft Systems Experiments**

The UoSAT-B spacecraft will carry a number of systems experiments alongside the science and education experiments described above. These system experiments are concerned with developing an improved, cost-effective spacecraft bus and experiment support facility for future low-earth orbit missions — with special emphasis on low-cost Get-Away-Special (GAS) payloads on the Shuttle.

1) Navigation, attitude control & stabilization

A low-cost, medium performance stabilization system is an essential feature for most low earth orbit secondary or GAS amateur payloads. Generally, most missions in this category need to point at the earth and, in most instances, the attitude requirements can be met by either an inertial, magnetic or an earth pointing stabilization mechanism with a pointing error not exceeding ±2 degrees. The stabilization mechanisms most suited to these requirements appear to be spin, magnetic and gravity gradient stabilization as none of these need employ expendable spacecraft resources for their long term operation. The UoSAT-1 mission was primarily intended to be earth-pointing utilizing gravity gradient techniques after an initial inertial, spin stabilized period — the necessary attitude maneuvers being effected by on-board magnetorquers. The very simple navigation instrumentation and single-axis magnetorquer on UoSAT-1 performed well, if with some difficulty due to their simple nature. The spacecraft was spin stabilized and successful magnetic attitude maneuvers demonstrated complete control over the spacecraft dynamics and placed it in the correct attitude for gravity gradient stabilization. The stabilizing boom, however, was prevented from deploying fully due to a snag of the cables feeding the scientific magnetometer within the tip-mass on the far end of the boom. Even with only a short (1m) deployment of the boom, the spacecraft was successfully gravity gradient stabilized for a few days with marginal stability after which it was returned to its spin stabilized state. The experiments carried out with UoSAT-1 demonstrated the basic feasibility of a low-cost attitude control and earth-pointing stabilization system, however the simplicity of the navigation sensors and the partial deployment of the boom prevented the study and evaluation of the operational performance of the system. It is proposed, therefore, to include improved navigation sensors (e.g. sun angle sensors, earth horizon sensors, improved navigation magnetometer) on UoSAT-B in addition to spin-axis and spin-plane magnetorquers and a reliable boom. This combination will enable the spacecraft to be navigated to an expected accuracy of within ±1 degree and a combination of passive nutation dampers and active magnetic damping (using the on-board computer) will contain the nutation and libration of the spacecraft to within an expected ±2 degrees. Low-cost sun-angle and earth horizon sensors will be included on this spacecraft in addition to an improved navigation magnetometer with a resolution of ±100 nT.

2) Computer hardware, software & memory technology

On-board memory storage has been a perennial requirement for spacecraft and now highlighted by the proposed Packet Radio Communications Satellite (PACSAT) being studied by AMSAT. Solid-state memory (as opposed to tape recorders) is becoming increasingly attractive, however little experience has been gathered as to the performance of many of these devices in a long-term space environment. As these devices represent the core of a PACSAT type spacecraft, the UoSAT-B mission will provide essential data. In conjunction with the Packet Communications Experiment above, various types of CMOS static and dynamic memory devices and a CMOS NSC800 microprocessor will be flown to assess their performance.

The spacecraft computers will have executive access to the spacecraft housekeeping functions and on-board experiments allowing the effectiveness of different software strategies to be assessed. The spacecraft computers will be utilized heavily for navigation, attitude control and stabilization. Software and data will be loaded from the ground command stations into the spacecraft computers as necessary.

3) Communication systems

The simple and effective transmission formats adopted for UoSAT-1 have proved highly successful for reception by low-cost ground stations but suffer from certain limitations at low signal levels and in noisy environments. It is proposed to experiment with error-resilient coding techniques and other transmission methods (while remaining simple and cheap to receive).

The 2.4 GHz experimental beacon on UoSAT-1 has generated great interest among radio amateurs who have developed low-cost microwave ground stations and it is proposed to stimulate this interest further by the inclusion of an operational 2.4 GHz downlink from UoSAT-B carrying telemetry and experiment data.

Once the UoSAT-B has been stabilized and commissioned, it is anticipated that one uplink will be made available to radio amateurs for general access to the Packet Communications Experiment, in order that the effectiveness of the on-board traffic control software can be studied in addition to the hardware in preparation for future PACSAT missions.

(Part II to appear in the next issue of *ORBIT* Magazine.)

Based on an article appearing in OSCAR NEWS, *the Journal of AMSAT-UK*.

**G3IOR**

# Worldwide Satellite Activity

### By Pat Gowen,* G3IOR

*WANTED: Information, operation, activities, photographs, listings, DX worked, propagational findings, news and views from YOUR area for* Orbit's *"World-Wide Satellite Activity" column. Pse send to G3IOR, QTHR, or tell him over AO-10.*

These words are being typed in late December 1983, in the early evening, at a time when 28, 21 and 14 MHz are all very dead. The solar cycle has hit a sudden and unexpected low; good hf communications are not expected for several years to come, and no sun-spots are in sight. Indeed, we users of satellites are very fortunate to be so well served. We can now be sure that with OSCAR 10 up and active we have the best band of all. Furthermore, we know exactly when it will be "open", to what areas, and exactly what we need by way of power, antenna, and system function.

RS-2 is still being heard while in sunlight with the telemetry sending "55" and "5015" on 29.40 MHz. However, there has been no further indication of any activity by the tranpsonder. All is quiet from both AMSAT-OSCAR 7 and AMSAT-OSCAR 8 with no sign yet of a Ni-Cd cell going open-circuit to permit direct solar-power operation. The powerful and hitherto continuously operating beacons of both RS-3 and RS-4 are both silent, the batteries having failed. There has been no sign since the first days of any use other than as highly effective beacons. RS-5, 6, 7, and 8 are currently suffering from eclipse problems, and are switching themselves off when an internal detection system senses that the D battery voltage channel drops to 62/63, indicating 12.5 V at the source. Once off, the systems can only be turned on by the command stations in UA3 or UA0, and thus are likely to stay off until in view of those that tend them. For much of the time the single battery voltage channel is being monitored, e.g. sending "D72" etc. That telemetry, particularly from stations that can receive the 'RADIO' birds when UA3 and UA0 cannot, and very especially from those that can copy when the satellites are close to the eclipse points of around 74°, are requested to send reports to Leo Labutin, UA3CR, c/o Central Radio Club, Post Office Box 88, Moscow, USSR. The telemetry information will be greatly appreciated by those who will study it. Thermal regulation of the Russian birds seems to be working well, as the satellites show little change from the normal 23 or 24°C at this time. The schedule for now, (which will change with insolation angle changes) calls for RS-6 to be active each Tuesday; RS-8 each Thursday; and RS-5 and RS-7 on Saturdays and Sundays. They may be commanded on at other times to give greater loading for experimental purposes. However, they should not be used at times outside that operating schedule.

UoSAT-OSCAR 9 still goes strong on a planned schedule, but no reports have come in to indicate that any hf beacon other than that on 21.002 MHz has been heard. The University of Surrey are working flat-out at this time to beat the world record for fastest satellite production. Every available moment and erg of energy are being devoted to get the best possible UoSAT-OSCAR 11 to meet a March launch schedule. Because of the absolute urgency of the building program, Martin, G3YJO, head of the project, is currently unable to respond to the many requests he is receiving for information about the project. It is felt that that would detract from the product. We do know that the FM Digitalker will be aboard, this time with a greater deviation to aid copy, plus many of UO-9's facilities improved. Exactly how much of what is desired gets aboard is entirely dictated by the restraints of the available time.

AMSAT-OSCAR 10, despite the limitations of the final orbit that causes a problem for optimum sun-angle relative to best earth antenna pointing (necessitating shutdown of the transponder around perigee) is giving sterling service with an ever increasing number of stations appearing weekly on both modes of operation. New and rare stations reported recently include JY9ZZ, FR1AC, Z22JE, HZ1AB, VP8NO, DJ4ZC/EA8 (Yes — Karl has taken a needed holiday in the Canary Isles), 4U1ITU (by HB9AYX), LA2PH/MM, UA0SBI, UA0LFK, OY9JD, RA0LFI, Y24QO, K6MYC/CE0, KH6IBA, FK8CR, YB0AQT, FC6GSE, KV4AD, ZS3B, KG6DX, and ZK2RS, all on Mode B. A92NH and BY1PK are expected to commence operation soon. Some of those stations run quite low power, and disap-

**Carlos, LU4ENG, AMSAT co-ordinator for South America, gives one of several conference presentations at the University of La Plata City.**

pear from the passband when alligators arise. Thus they are quite difficult to hear Europe, where the spacecraft is so frequently driven to distraction.

On the first Monday QRP day, when the satellite was out of range for Europe, Nick, W0CA ran between 2 and 5 W of power for solid QSO's with a readability of "5", with W3IWI, KO5I, W6WBY K6JA, ZL1TCF, W4LQE, KB4CRT, WB6LLO, K5SM, WB9CNS, W6HDT, and KL7WE! All were running an average of 4 W, with KL7WE only 1 W! In addition, he worked 8G5, OE1, ZS6, FC6, OK1, SP9, UA3, I5, SV3, JA, DL, HB, H44, ZL, GM, LX, HG, YU, YO, A71, GW, P29, UL, UB, GU, OY, and a host of European stations. Nick is aiding I4MKN to go to P77A and in getting 5N8ARY onto OSCAR 10. Unfortunately he missed K6MYC's Easter Island trip as he was en route from Minnesota to Florida at the time.

Giorgio, I3LCZ, regrets that he is having problems in getting his nominally powered signals into the satellite. The cause are high-power users, many of whom, he regrets, are of his own country. The H1 GB2RS broadcasts that he would like to hear for their information content (and which use the recommended 1 kW eirp) are attenuated out by the alligators.

Mode L is rapidly increasing in popularity and at least 42 different stations have made two-way QSOs through the transponder. The transponder is quite sensitive and can generate QSOs for those using just the original estimated 1 kW eirp. Ivo, ZS6AXT, with less than 1 kW erp hears his own signal well, and feels that, like Mode B, it is attention toward a superior receiving system that counts. Ted, W4FJ, a satellite pioneer, comments that he was hearing good signals on Mode L at the time other listeners were saying the band was empty, thus reinforcing Ivo's comment. Ted can hear Ivo, but it appears that many will not until they get receivers as sensitive as Ted's.

**The OSCAR-10 antenna farm at LU4ENQ includes the 70-cm helix mounted and ready for action.**

European stations make up a large majority of Mode L users, due probably in large measure to the fact that a vhf-only license exists, that in Region 1 there are generally no 50- or 220-MHz bands, and 2 meters is available only to 146 MHz. Thus, early work went into use of uhf and microwave bands. That is evidenced by the dominance of Europeans during the early months of AMSAT-OSCAR 7 on Mode B back in 1974 and 1975.

As a guide to who is using what on Mode L, we reproduce below information from the well documented regular reports sent in by Bill, K0RZ, of stations worked on the new mode between 436.450 and 436.550 MHz downlink, where activity and sensitivity are greatest.

| Date | UTC | Station | RST Out/In | Other Station Details |
|---|---|---|---|---|
| 21/9/83 | 1940 | F9FT | 539/529 | 150W to 4 x 23 el Yagis |
| 5/10/83 | 2149 | DJ5BV | 549/519 | 400W, 16 x 23 el Yagis |
| 5/10/83 | 2211 | VE7BBG | 56/55 | 2.5W, 25' dish |
| 5/10/83 | 2229 | K6MYC | 56/419 | 20W, 16' dish |
| 5/10/83 | 2241 | W8YIO | 429/529 | 10W, 4.2' dish |
| 8/10/83 | 1946 | DJ3OS | 559/559 | 5000W eirp |
| 8/10/83 | 2037 | DJ8QL | 579/559 | 20W, 16' dish |
| 15/10/83 | 0332 | JR4BRS | 51/43 | 3-m dish |
| 15/10/83 | 0417 | VK5QR | 559/229 | 90W, 2-m dish |
| 29/10/83 | 1624 | ZS6AXT | 559/559 | 100W, 16 el Quagi |
| 29/10/83 | 1630 | DL1BU | 569/559 | 100W, 2-m dish |
| 29/10/83 | 1721 | OE9FKI | 539/519 | Unknown |
| 29/10/83 | 1745 | DJ9PC | 569/529 | 200W, 3-m dish |
| 29/10/83 | 1814 | OE9XXI | 56/54 | 50 W, 26' dish |
| 2/11/83 | 0251 | JA3EUP | 22/54 | Unknown |
| 12/11/83 | 1938 | G3WDG | 569/559 | 100 W, 5' dish |
| 12/11/83 | 2008 | PA0SSB | 42/53 | 2W to single Yagi |
| 16/11/83 | 1644 | DL7YC | 57/55 | 70W, 3-m dish |
| 23/11/83 | 2340 | W0HHE | 57/54 | 100 W, 20 dish |
| 24/11/83 | 0032 | VE7CLD | 54/53 | Unknown |
| 26/11/83 | 2222 | KL7NO | 419/519 | 1000 W eirp |

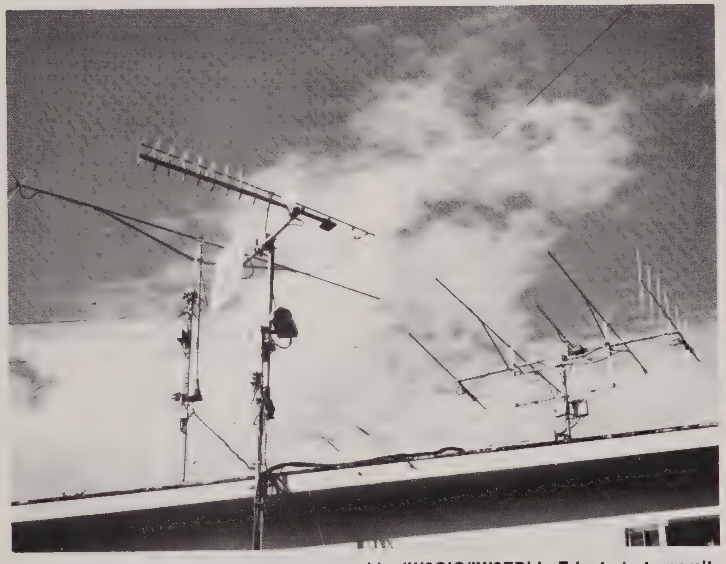
Bill uses two 38-element loop Yagi antennas with a measured gain of +22 dBd. With 120 W of rf on 1269 MHz, he gets 20 kW eirp, allowing for feedline losses. For the downlink, he employs eight horizontally-polarized, 15-element NBS Yagis (Tech note 688) with 22 dBd of gain. The complete system, with a GaAs FET preamplifier, shows between 9 and 12 dB of sun noise.

Bill copies his own signal at RS 52, some 8 dB above the noise. The beacon is 25 dB over the noise. Yet Bill can copy his own signals with just 5 kW eirp on the uplink. Only K6MYC and VE7BBG (with 250 kW eirp) come close to the beacon's strength. It is very apparent that intermod and cross mod are present on the downlink, and that the keying of the beacon affects the signal strength by some 6 dB on key-down.

Other stations known to have been active on Mode L include DC6YU, DK2ZF, OE1HAB, I5CTE, DJ5KQ, HB9CAI, OE1VKW, DL7ZL, G4KGC, JA4CDC, DL3NQ, HB9MKQ, JA1SYK, DL9GU, GW3XYW, JA4GVA, DJ7BG, OE1ERC/1, and DK1TB. It certainly appears that Mode L is justifying its employment, even if just for some eight hours per week. It gives an excellent productive development base to justify the work and cost involved at uhf, as well as permitting OSCAR 10 use by those harassed by FM in the satellite sub-band of two meters.

Adam, SP9DH, reports that in addition to himself, SP2AOZ, SP6ASD, SP9EVP, SP2IHG, and SP2DFW are all now active on OSCAR 10 and are getting good results, with QSOs out to Australia. Adam has added to his all-time satellite country score on B mode by working ZS6AXT, VK5QR, YB0AQT, ZS3B, H44PT, 4U1ITU and PY6HL to bring him to 90 DXCC countries worked. He has also added to his score via the RS series with UD6DFD, UK2FAA, ZC4RH, UM8MBW, A4XIZ, UI8AEG, KL7X, and UJ8JKD. Adam runs between 5 and 8 W to a 12- or 17-element Yagi for Mode B, with either a 5- or 9-element Yagi to a BF180 pre-amp for the downlink. The setup performs very well when the satellite is not overloaded with QRO stations. His best DX to date is VK7PF in Tasmania, a distance of 15,890 km.

TU2IE writes that he has managed to get his equipment for AO-10 through Customs, and will join TU2GA on the satellite. He will be joined soon by TU2IT. At the Ivory Coast, the satellite is often at 90° elevation, and it is sad to note that the transponder goes off frequently when he has superb access and strong beacon signals. Power supply problems of a different type face the TU satellite fans. Reservoirs are almost empty, even at the end of the rainy season, with the result that electricity outages occur twice daily to reduce consumption. What is worse, the old diesel generators have not been maintained, so the big power plant cannot be re-activated now.



**A pair of crossed Tonna antennas are used by IW3QIO/IW3EDI in Trieste to transmit to OSCAR 10 in Mode B. Two bays of 7/7 homebrews are used for reception and feed a BF981 preamplifier before sending the 2-meter signal to a Trio-Kenwood TS-770. A 16-element Tonna is used for backup. For Mode L, either a 23-element Yagi or four 10-turn helices are used. A Lunar preamp improves reception.**

Lars, SM3AVQ, writes on behalf of the Swedish SSA Society to correct my statement made in the May/June issue of *Orbit* that "...many societies in Europe have done nothing to stop or shift the offending repeaters on 145.800 or 145.825 MHz..." Lars assures us that SSA has done a lot of work in finding new channels for the repeaters on 145.825 MHz, but they have not been very successful, having only succeeded in shifting the Halmstad repeater from 145.825 to 145.675 MHz. In Sweden, that leaves nine repeaters with output on 145.800 MHz and three on 145.825 MHz, plus, of course, many more throughout Europe except in Britain, where RSGB have consistently opposed the use of the satellite band for repeater use. To quote the letter from Lars..."...they will certainly not be closed by their owners voluntarily...the repeater users are also far more numerous than the satellite users, and considering that they were using the frequency first they apparently see the satellite users as intruders. Here in Sweden the Teleauthority closes a repeater only if the traffic over it badly offends against the rules. They will not close a repeater on request of the SSA and consequently the SSA have no power to 'shut-off'..." Lars points out that the wording of the minutes of the 1981 conference of IARU Region 1 did not explicitely call for the removal of existing repeaters in the satellite band, so, it appears that little more can be done until AMSAT have full representation at IARU meetings. Because IARU members are there on a national basis, e.g. not an international basis, we have no reason to expect representation under the current rules. Thus we can only work as separate entities through our existing national societies unless we can apply pressure for a change in the rules of membership that will give us a voice, in our own right, at all regional conferences that decide "the rules."

The last RSF/RADIO 'RS' contest had its rules changed so that a station could be worked only once in the contest period. That had been a suggestion from

*(Continued on page 26)*

# W6SPACE PHILOSOPHER

By John Browning, W6SP

Amateur columnists often emulate real writers by quoting profound words attributed to prominent people. But sometimes we come up short. After selecting a particular subject, we may discover that no appropriate famous saying comes to mind. We must then risk inventing our own. As an example, let me try the following: "Every successful enterprise is populated by capable leaders and motivated followers." Now just because you can't find that particular gem in your favorite book of quotations (yet), doesn't mean it isn't true. Granted, in some organizations, it may be difficult to sort out the two categories of folks. Certain people manage to perform both functions simultaneously. Thus, we frequently observe effective leaders who are also good subordinates for their superiors. And the two categories have at least one quality in common. Since we are considering successful efforts, both positions must be occupied by reliable "doers."

In reminiscing about my own experiences with leaders, I quickly get back to the era of early direct involvement of the United States in World War II (1942). My eighteenth birthday preceded the first military service drafting of 18-year-olds by two weeks. Along with many of my peers, I successfully evaded draft registration through the practical expediency of enlisting in the Army as a private. As a result, I quickly learned to "follow" a corporal who liked to get places in a hurry by having his troops double-time in formation at every opportunity. His incentive for that was quite clear — by arriving early for the next scheduled training activity, we were able to maximize the time devoted to standing in line awaiting the start of interesting things, such as a Morse code class. Most of us found that mode of transportation extremely fatiguing. We were just smart enough to figure out why. We were running at someone else's pace! An obvious advantage to becoming a leader is that you get to set the pace. Some disadvantages are that you must know where you are going and understand how to hold the formation when it has arrived at its destination.

Fortunately, we got to travel by train from one base to another. Those transfers occurred every few months as individual phases of flight training were completed. The facilities all seemed identical; large mass-produced military installations positioned near small cities. But their environments varied tremendously. One post had good morale and an excellent safety record while the next was the opposite in every important way. It took longer for us to figure that one out but, again, it was leadership. In those days, a base commander was sufficiently authoritarian to cause overall station performance to reflect his personal ability, initiative and management style.

Four years later, many of us surviving young servicemen suddenly became old college students. My own decision was to leave a southern California airbase for West Virginia University. The choice was easy. WVU is a well-regarded institution of higher learning and my all-time favorite young lady was a student there. Postwar radio engineering textbooks also came from California. They were authored by Frederick E. Terman, Sc.D., Professor of Electrical Engineering, and Dean of the School of Engineering at Stanford University. Although I had never heard of Dr. Terman, his texts were being used by electrical engineering schools all across the country. It was immediately obvious that those books possessed a clarity unusual for highly technical works. They quickly provided sufficient understanding of certain electronic knowledge which, when coupled with earlier breathlessly acquired Morse skills, resulted in the licensing of a new amateur station in Morgantown, West Virginia, W8DDF. Much later, I learned I had briefly followed in the footsteps of a great man. While he was a student at Stanford, Dr. Terman operated as 6AE. He subsequently accomplished so much more that it almost defies duplication. As a result, he became deservedly world famous as a leader and a competent advisor. If one explores the phenomenon of "Silicon Valley," the vast solid state electronic development region now stretching southward from the Stanford campus and then asks, "How did it happen?", the answer consistently comes back, "Through Fred Terman's understanding, foresight, advice, and encouragement." He led and inspired hundreds of Hewletts and Packards and Watkins and Johnsons to their own impressive electronic achievements.

Another familiar example of the qualities of leadership shining through an organization was the progress of the American Radio Relay League under the stewardship of Vic Clark, W4KFC. Few amateurs will dispute that in the two-year period of his presidency, the League acquired and reflected many of his outstanding personal attributes and sense of priorities. Unfortunately, the keys of both 6AE and W4KFC are now silent.

During the relatively short time that AMSAT has existed our organization has been led by just two people: Perry Klein, W3PK, and, in turn, Tom Clark, W3IWI. Our presidents have shared many of the characteristics essential for the success of a volunteer staffed, progressive, technical corporation. They are both scientists who are entitled to be addressed as "Doctor." More importantly, they possess the critical foresight to visualize practical courses of action for leading our advancements in amateur space activities. Without their talented contributions, there would be no AMSAT.

As we look deeper into the AMSAT hierarchy, another standout immediately appears — Jan King, W3GEY. His leadership qualities are obvious. In addition, he has the rare talent to comprehend and bring together the myriad of technical disciplines involved in creating functional and reliable satellites. Furthermore, he understands how to relate essential technical work to the conglomerate world of membership opinion and project funding. A counterpart, who is well recognized for having been essential to the earlier Project Oscar successes, is Lance Ginner, K6GSJ. Jan and Lance are members of an extremely rare breed that also includes Karl Meinzer, DJ4ZC, and Martin Sweeting, G3YJO. Fortunately for our future, a few talented newcomers are in the process of honing similar technical leadership skills. We are just starting to hear of them.

How about us followers? We know we are essential because there is a lot of important hard work remaining to be done. We can help the leaders accurately judge our capabilities by volunteering to accomplish specific essential tasks and then keeping our promises. And we can take comfort in the words of Will Rogers who once said, "We can't all be heroes. Somebody has to set on the curb and clap!"

# AMSAT News

**Organizational items of interest to all members of the Radio Amateur Satellite Corporation**

## Member Drive Winners Told

AMSAT Headquarters has announced the winners in the first-ever member recruitment contest. The six-month campaign netted 370 new members according to General Manager Bill Lazzaro, N2CF. Prizes were shipped the week of January 16. The winners, their scores and prizes are shown in the box accompanying this article.

The contest period ran from July 1 through December 31. Prizes ranged from an option-laden grand prize all-mode vhf/uhf transceiver, the FT-726R from Yaesu worth nearly $1400 to prizes for as few as one new member signed. In all, nearly $3000 in prizes were donated by manufacturers and distributors of amateur satellite-related equipment.

Individuals who participated in the contest should call or write AMSAT soon to claim their prize. (Does not include those whose callsign appears in the box; their prizes have already been shipped.!) As explained in *ORBIT* No. 14, page 28, the following prizes are yours if you participated but did not garner one of the main prizes.

For one point you earned either your name in space or an AMSAT callsign badge. For two points you can choose either an AMSAT T-shirt or belt buckle. Three points gets you either a credit at the AMSAT Software Exchange or a copy of K2UBC's new book *Satellite Experimenters' Handbook*. For four points or more you can choose either a year's AMSAT membership or a year's ASR subscription. Please claim your prize promptly.

According to N2CF, the recruitment drive will be repeated later this year with a kick-off announcement expected in the next few weeks. He wants to have the contest period bridge the peak of the hamfest and convention season to afford the broadest possible exposure and opportunity for this contest reprieve.

AMSAT congratulates the winners and all the participants who made this premiere effort a huge success. The big winners may be the new members who've just joined the most exciting activity in Amateur Radio today.

A special note of thanks and sincere appreciation to the very special group of manufacturers and dealers who, without so much as an arm-twist, practically leaped on the bandwagon to make this effort the most successful campaign of its kind to date. Our hats are doffed to you truly fine (and visionary) folks! Thanks! You made it work.

## PACSAT Presentation Stimulates College Interest

Returning from a trip to England's University of Surrey, home of UoSAT B and UoSAT OSCAR 9, AMSAT's Assistant Vice President Harold Price, NK6K, found time to stop off at Morgantown, West Virginia. The occasion was a meeting of the Institute of Electrical and Electronic Engineers (IEEE) at West Virginia University and NK6K was the featured speaker.

On Thursday evening, 19 Jan., Harold was joined by N2CF at West Virginia University , a four hour drive west from Washington, D.C., for this important talk. As is often the case with NK6K's presentations, this one was both informative and entertaining. AMSAT officials were hosted by the Chairman of the

| Place | Call | Score | Prize | | | |
|---|---|---|---|---|---|---|
| | | | *Manufacturer* | *Model* | *Function* | *Donor* |
| 1 | N3CEG | 71 | Yaesu | FT-726R | All-mode vhf/uhf transceiver | Yaesu-Musen |
| 2 | KW2U | 68* | Mirage | D-1010N | 70cm 100-watt amplifier | Mirage |
| 3 | WD4FAB | 20 | Microwave Modules | MMX-1268-144 | 2m to 23cm xmit conv., 2w | Spectrum Inter |
| 4 | WA6VGS | 18 | Astron | VS-35M | 35A metered dc pwr supply | KJI Electronics |
| 5 | K8OCL | 16 | KLM | 2M-14C | 2m crossed Yagi | KLM |
| 6 | W3LOY | 13 | Lunar | PAG-144-2 | 2m GaAsFET preamp. | Lunar |
| 7 | WB5PMR | 12 | Adv. Rec. Research | P144VDG | 2m GaAsFET preamp. | Adv. Rec. Research |
| 8 | K8MU | 9 | KLM | 435-18C + CS2 | 70cm crossed Yagi & pol. sw. | KLM |
| 9† | W6ISO | 8 | Lunar | PAI-144-2 | 2m preamp. | Lunar |
| 9† | W3IWI | 8 | KenPro | KP-145G | Mast 2m GaAsFET preamp. | Spectrum West |
| 11†† | KO5I | 7 | Mutek | SLNA-144S | 2m in-line preamp. | VHF Shop |

**Notes:** * *final score is* $68^{1}/_{12}$ *points with* $^{1}/_{12}$ *point for family members.*
† *Tie for ninth place.*
†† *Bonus prize donated by the VHF Shop!*

Electrical Engineering Department, Dr. Roy Nutter, N8BHI.

The one hour presentation was enthusiastically received by about 50 students and faculty on a blistery, cold evening. Viewgraphs supported the verbal description of the PACSAT project.

PACSAT, the forerunner of a family of digital, store-and-forward satellites, is a joint project of AMSAT and VITA, the Volunteers In Technical Assistance. A 1985 or 1986 launch opportunity from a Get Away Special (GAS Can) on a future Shuttle is being sought.

General Manager N2CF explained to *ASR* that AMSAT views the nation's university and college system as a virtual boundless reservoir of engineering talent searching for worthwhile projects. The West Virginia opportunity is a "very promising situation" says N2CF. "We hope to promulgate the idea of participation in amateur satellite projects to numerous other universities," he added.

Weber State College in Utah is building a satellite under the experienced hand of Gil Moore of Thiokol. Gil has played a key role in past AMSAT activities in connection with the Thiokol kick motors.

The West Virginia University group was particularly interested in participating in development of the digital equipment and propulsion system. Many are licensed radio amateurs. with a double interest in the project: Engineering and Amateur Radio.

AMSAT is keenly interested in developing relations with universities and colleges through engineering faculty and students who are licensed amateurs. Interested individuals should contact Bill Lazzaro, N2CF, General Manager at 301-589-6062 or write AMSAT, P.O. Box 27, Washington DC 20044.

The West Virginia presentation was arranged by AMSAT Chairman John Browning, W6SP, who is a West Virginia University alumnus (BSEE, '49). On a trip to his home last Spring he met Dr. Jerry Finucci, K8JF, Professor of Aerospace Engineering and arranged for the presentation. Another helping was Dr. Mike Palmer, K8LG. W6SP had hoped to be at the presentation Thursday but irrevocable business commitments precluded the trip.

## New Bulletins Favorably Received

A new service developed *ad hoc* on AMSAT OSCAR 10 is drawing favorable remarks from those who've heard the effort of W6KAG and W6CG. Bud Schultz, W6CG, has for several years been holding regular Saturday nets on 10 meters (lately on 15 meters) primarily in service to New Zealand, Australia and the Pacific basin area. The Southwest Pacific AMSAT information Net has provided key information to hundreds in its tenure.

Now in an effort to better serve a wider community yet, W6CG has teamed with Butch Mason, W6KAG, to relay Bud's bulletin service abroad via AO-10. The result to date has been a very effective service according to those who have listened in. The bulletins are transmitted on Special Service Channel H2 (145.962 MHz). The SSCs were established precisely for the kind of service now being provided by W6KAG and W6CG, according to AMSAT sources.

In the present arrangement, W6KAG tape records W6CG and later transmits the audio to AO-10 from a 20-minute continuous loop tape. Both W6KAG and W6CG are retired and thus have the time to devote to this valuable public service. Both are located in the Los Angeles environs. Butch is in Rancho Palos Verdes and Bud in Anaheim.

The present schedule of transmissions is as follows according to W6CG: On Mode B days (Sun., Tue., Thur., Fri.), the bulletins will be transmitted from one hour prior to, through one hour subsequent to AO-10 apogee whenever that apogee occurs between 60 and 180 degrees West longitude. There will be no bulletins on Mondays, QRP days. On Mode L days (Saturday and Wednesday UTC), the bulletins will be transmitted from one hour through two hours subsequent to apogee whenever that apogee occurs between 60 and 180 degrees West longitude.

## Project OSCAR Auunal Meeting is Held

President John Pronko, W6XN, of the Project OSCAR group reports on the Annual Meeting which was held on 14 January at Foothill College, Los Altos, California. The meeting was held between 2 and 5:30 P.M. with 37 members attending.

W6XN reported on Project OSCAR Predicton Calendars. He was followed by WB6JNN who presented a Syncart progress report. KA6M told of packet activity on AO-10. W6SP detailed current and future AMSAT projects. N6TX reported on the W5LFL Ham-in-Space mission.

Election of Board members was followed by election of Officers. Incumbents were all re-elected. The Officers are: President, John Pronko, W6XN; Secretary, Nick Marshall, W6OLO; Treasurer, Gil Morris, WB6KCG; Chairman of the Board, John Browning, W6SP; Technical Director, Jim Eagleson, WB6JNN

W6XN reports that lively discussion permeated the entire meeting!

## The AMSAT-Stoner Challange Cup

### An International Amateur Radio Satellite Competition

Bill Orr, W6SAI, is one of Amateur Radio's best known and respected authors. In a now-classic *QST* article ("Sixty Years of Radio Amateur Communication", *QST*, Feb. 1962) Bill recounted a bit of history. It was one of those pivotal moments in the fascinating genesis of amateur satellites. Bill's telling goes thus:

*"The radio amateur gazed thoughtfully for a moment at the white paper in his typewriter. Suddenly his fingers sprang into action and the keys flashed the fateful words, 'Currently being tested is a solar powered six-to-two-meter transistor repeater which could be ballooned over the Southwest. Can anyone come up with a spare rocket for orbiting purposes'.*

The fingers were those of Don Stoner, W6TNS, writing his "Semiconductors" column for *CQ*. The "fateful words", as W6SAI later put it, appeared in the April 1959 edition of *CQ*. From that point hence there existed a remarkable series of events resulting in OSCAR 1 (December 1961) through the recent launch of AMSAT-OSCAR 10, the most advanced of the proud lineage. But arguably it all began with those "fateful words" two and half decades ago.

Now AMSAT is set to commemorate the 25th anniversary of Don Stoner's challenge to "come up with a spare rocket" with a challenge of its own. The AMSAT-Stoner Challence Cup for amateur satellite enthusiasts will begin in April and aims to simultaneoustly recall the lineage while fixing sights firmly on the future of amateur radio in space with OSCAR. The AMSAT-Stoner Challenge Cup will take the form of an operating competition on AMSAT-OSCAR 10. The competition will run for three months and offers the winners in three categories substantial hardware (trophies, plaques) and software (certificates).

The competition is open to licensed amateurs and amateur radio satellite enthusiasts worldwide. The purpose of the competition will be to promote satellite activity through familiarity with its capabilities, to AMSAT membership and to stimulate refinement of ground station performance with especial emphasis on receive capabilities.

The competition shall be held in three sections:

1. AMSAT members

2. Non-AMSAT members
3. SWLs (both members and non-members).

The general idea is to work as many stations in as many different grid squares as possible. Special emphasis (through scoring method) is placed on low-power transmitting and superior receive capability through bonus points. Grid squares are a universal system of dividing the earth's surface into uniquely identifiable zones 2 degrees by 1 degree (longitude by latitude, respectively). The grid square system is described in *QST*, January, 1983, page 49. The article describes how to ascertain your own grid square identification. For example, ARRL Headquarters is at grid FN31. A more complete explanation, including the plan for locations outside the USA appears in "The Lunar Letter", April 1982, in an article entitled, "Worldwide QTH Locator System Proposed By Region 1," by Lance Collister, WA1JXN.

AMSAT will supply copies of the articles describing the system together with sample logs for this competition for $2 plus a SASE or (overseas) for $2 plus an SAE with 5 IRCs.

Complete rules are specified below. Because of the sensitivity of AMSAT OSCAR-10 to possible "desense" due to excessivily high power on the uplink, the rules will be strictly enforced. Disqualification of stations using excessive power may result. This being the first-ever competition of its type, AMSAT has resolved to approach the activity with cautious optimism. A disciplined, mature approach to the competition is thus required of all participants. Unlike hf competitions where the sponsors can hardly turn off the ionosphere, THIS "ionosphere" can be turned off should things get out of hand.

The AMSAT-Stoner Challenge Cup is a benchmark for future, longer-termed AO-10 operating events and even AMSAT's Technical Achievement Award for superior ground station capability (especially receiver performance).

So step up to the ultimate in space-age amateur radio events: The AMSAT-Stoner Challenge Cup on AO-10! GL! — *Doug Loughmiller, KO5I, AMSAT Vice President, Operations*

## AMSAT-Stoner Challenge Cup

## Official Rules

1) Objective: Two-way communication via AO-10 Mode B or Mode L using the lowest uplink power possible. For SWLs, the objective is to report as many QSOs as possible with special emphasis on those QSOs involving QRP stations.

2) Competition Period: Commencing 0000 UTC 15 Apr. 84 and running continuously through 2400 UTC 14 July 84. No time limit on cumulative operating time.

3)Entry Categories:

a) Challenger Class (AMSAT Members only; affiliated AMSAT organizations are included, e.g., AMSAT-UK, AMSAT-DL, JAMSAT, etc.)

b) Competitor Class (Future AMSAT Members; not currently members)

c) Observer Class (SWLs; includes hams not presently equipped for AO-10 both members and future members)

4) Exchange: QSO serial number, uplink power code, grid square and AMSAT member number (if any). See below for power code.

5) Scoring:

Scoring is based on three major elements:

a) QSO points which are earned for each QSO completed. Credit is given in inverse proportion to the uplink power employed. Basically the lower the power, the more points you get for each QSO. Points per QSO will vary both with your uplink and the other stations uplink and are computed on a QSO-by-QSO basis. See below.

b) AMSAT Member multiplier. Each AMSAT member worked doubles the point value of each QSO. Thus an AMSAT member QSO gives you a member multiplier of two. Non-member QSO multiplier is one.

c) Grid square multiplier. The multiplier is equal to one unit for each DISTINCT grid square worked.

For observer class, simply report the power codes of each side of the QSO but do not apply the member multiplier or the grid square multiplier. Observer's score is then the sum of individual QSO power codes as described below.

Scoring details:

QSO Points. Based on the matrix and explanation below.

Uplink power code A is 200 watts EIRP or less.

Uplink power code B is 201 to 800 watts EIRP.

Uplink power greater than 800 watts on Mode B is not permitted.

Uplink power is not limited on Mode L and each QSO is scored as if it were Mode B, code A.

|  |  | Your Uplink |  |
|---|---|---|---|
|  |  | A | B |
| Other Station Uplink | A | 5 | 3 |
|  | B | 3 | 1 |

From the matrix one can deduce the following. For QSO points, each QSO in which BOTH stations use less than 200 watts EIRP (code AA), the QSO points total 5. If either station uses less than 200 watts (code AB and BA) the QSO is worth 3 points. If both stations use between 200 and 800, (code BB) the QSO earns 1 point.

Sample Scoring calculation:

You work an AMSAT member. He's running 500 watts EIRP; you're running 125 watts. The QSO points are 3 (code BA). Since he's a member, the member multiplier is 2. The total worth of the QSO is thus 3 x 2 = 6 points.

You work another station. He's not a member. Both of you are running 100 watts EIRP. The QSO points are 5 (code AA). The member multiplier is 1. (He's not a member). The QSO total is thus 5 x 1 = 5 points.

After all individual QSOs are tallied, the subtotal is multiplied by the grid square multiplier. Suppose your QSO sub-total is 1250 points. Suppose you worked 200 grid squares. Take the QSO points subtotal (1250) and multiply it by the number of different grid squares you worked. Thus: 1250 x 200 = 250,000 points; your grand total.

6) Logs: Log sheets may be obtained from AMSAT as described elsewhere. Home made logs are okay too as long as the following format is followed:

7) Miscellaneous: No repeat contacts. One credit only for each station callsign worked. The QTH of your station is optional and can be moved at any time to any other QTH with unlimited freedom. Cw and ssb are the only modes permitted in this initial event. Note the affiliation of the member next to the member number using a convenient abbreviation with notes to indicate what it means, e.g., UK, DL, VE, ZL, etc.

8) Reporting: Logs must be sent to AMSAT, P.O. Box 27, Washington DC 20044 and must be postmarked not later than 1 Sept. 84. A summary sheet must be included to indicate grid square total and QSO point sub-total. A signed statement attesting to the accuracy of the log must be enclosed and the entrant must state the maximum power used did not exceed 800 watts EIRP on Mode B. (No limit on Mode L).

9)Awards:

a) Challenger Class. First place will be honored with a silver loving cup engraved with "AMSAT-Stoner Challenge Cup, 1984. FIRST PLACE (your callsign)". The next 4 finishers will receive plaques. The next 5 finishers will receive special certificates. All entrants in the Challenger Class will receive a certificate.

b) Competitor Class. First place will receive an engraved plaque with the winners callsign and a one year AMSAT Membership. The next four finishers will receive special certificates.

c) Observer Class. The top 5 Observers

will receive certificates.

10) Costs: A nominal entry fee is required to offset the costs of administration. AMSAT members fee is $2; non-members is $3.

11) Disqualification: An entrant may be disqualified for:
   a) More than 2% log dupes (Callsigns or grid squares claimed)
   b) Consistently exceeding the Mode B General Beacon (145.810 MHz) by 6 dB or more; about one S-unit.
   c) Behavior incongruous with good amateur radio practice.

### Challenge Cup Rules Clarified

Several inquiries regarding the AMSAT-Stoner 25th Anniversary Challenge Cup have arisen. KO5I and his planning staff advise as follows regarding the inquiries.

a) An affiliated AMSAT organization in the context of this event is a national AMSAT organization such as AMSAT DL or AMSAT UK. This does not include radio clubs which are "Member Societies".

b) Under the rules, section 7), Miscellaneous, amend as follows:

"7) Miscellaneous: No repeat QSOs. A repeat QSO is one for which the other callsign, his grid square and your grid square are identical to a prior QSO. If any of the three elements (call, his grid or your grid) are different, it counts as a new contact. If either you or the other station (or both) move to a new grid square, the ensuing QSO counts as a new contact. One QSO is credited for each unique call-grid(his)-grid(yours) worked. The QTH of your station can be moved at any time." Balance of 7) unchanged.

c) Under the rules, section 8) Reporting, add the following:

"Your log must clearly indicate your grid square for each QSO claimed. If your QTH remains fixed, indicate your grid square once on each log page.

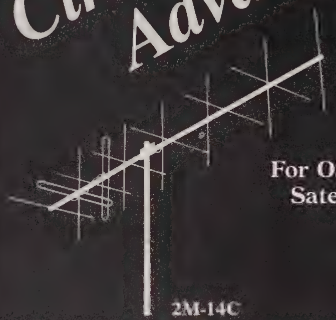
Perhaps an example will illustrate.

On opening day I work KO5I in Paris, TX from Warwick, NY. That's one QSO. A week later KO5I shows up operating portable from Norwich, England and we again work. That's the second QSO. The next day I travel to Omaha (a new grid) and work KO5I again. That's 3. Then, while I'm still in Omaha, KO51 returns to Paris and we again work. That's 4. Each QSO is unique and counts since each was a unique combination of call-grid-grid. (His call, his grid, my grid).

### US Amateurs Win Radio Sport Medals

ARRL received from the Soviet Radio Sport Federation, medals and certificates for five US amateurs. The Radio Sport Federation sponsored a series of activity

The Circular Advantage



For OSCAR 10 and Russian Satellite Communications

2M-14C

KLM's Circular Polarized antennas have been specifically designed to optimize OSCAR 10 and Russian satellite operation. Quality workmanship and superior design, yield virtually perfect circular patterns over the satellite operational bandwidth. Enjoy less Multi-Path Distortion, less Flutter, Fade, and better S/N Ratios, with comparable performance on transmit.

Both the 2M-14C and 435-18C sport virtually unbreakable 3/16" rod parasitic elements anchored thru the boom, folded dipole driven elements produce excellent physical and electrical symmetry for years of constant performance.

Specifications: (2M-14C)

BANDWIDTH: .. 144–150 MHz
GAIN: ................ 11 dBdc
BEAMWIDTH: ............ 48°
FEED IMP: ..... 50 ohm unbal.
BALUN: ............. 4:1,2KW
BOOM LENGTH: ......... 12'9"
VSWR: .................. 1.2:1
WINDLOAD: ........ 1.25 sq. ft.
WT. (LBS): ................ 7.5
ELLIPTICITY: ...... 3 dB Max.
CIRCULARITY SWITCHER: ..................... INCLUDED

The 435-18C is a star performer, an optional CS-2 circularity switcher puts left, and right-hand circular control in your shack, and doubles as a two port divider/impedance transformer for single feed line convenience.

435-18C

Specifications: (435-18C)

BANDWIDTH: .. 420–450 MHz
BOOM LENGTH: ...... 7.3 ft.
BEAMWIDTH: ............ 44
WT. (LBS): ............... 4.5
MAST DIA: ..... Cen–Rear/1½"
GAIN: .................. 12 dBdc
VSWR: .................. 1.5:1
FEED IMP: .... 50 ohm unbal.
BALUN: ......... 2–4:1, 1KW
ELLIPTICITY: ...... 3dB MAX.
CIRCULARITY SWITCHER ..................... (CS-2) OPTIONAL

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KLM electronics Inc.
P.O. Box 816, Morgan Hill, CA 95037

weekends throughout the month of October 1982. This operating event was to commemorate the October 3, 1957 launch of Sputnik and the October 28, 1978 launch of RADIO-1 and RADIO-2.

*1st Catagory winners were:*

W1NU 1st place Gold medal with certificate #261 and score 243.
N4AR 2nd place Silver medal with certificate #266 and score 202.
K9GQ 3rd place Bronze medal with certificate #269 and score 181.

*2nd Catagory:*

N2AA 1st place Gold medal with certificate #271 and score 114.
WB5EUC 3rd place Bronze with certificate #274 and score 34.

### More DX Showing Up On AO-10

As announced in *ASR* #69, *ASR* will occasionally publish a list of country/prefixes which have been active on AO-10. The following is the first occasion. Thanks go to G3IOR, W8DX, WH6AMX, W0TT and W0CY for sharing their "scorecards" with us!

A7, CE, CE0A, CT, CX (imminent ops by LU1ACH a/o 12 Feb 84 roported by LU4ENQ), DJ/DK/DL, DU, EA, EA8, EI, F, FC, FK8, FM, G, GI, GJ, GM, GW, HB, HB0, HC, HG, HL, HZ, H44, I, JA, JY, K,W,N, KG4, KG6, KL7, KP2, KP4, KV4, LA, LU, LX, OE, OH, OK, ON, OY, OZ, PA, PJ2, PY, P2, SM, SP, SV, TI, TR, TU, UA1,3,4, UA9,0, UB, UL7, VE, VK, VP2, VP8, VP9, VS6, VU, V3, WH6, XE, YB, YO, YU, YV, Y2, ZD8, ZK2, ZL, ZS, Z25, ZS3, 3A, 3D2, 4U1, 4X, 5N8, 9H1, 9M2, 9Y4.

That makes 89. Additional inputs are welcome. We'll run the additions when they accumulate to significant numbers.

### ARRL Sponsors Digital Conference

The American Radio Relay League will hold its Third Amateur Radio Computer Networking Conference on April 15, 1984 in Trenton, N.J. The conference will be held in cooperation with the 9th Trenton Computer Festival (TCF84) being held April 14-15 at Trenton State college.

Technical papers on many aspects of amateur packet radio, AMTOR, computer-based message systems, digital speech, presentation-level graphics and related Amateur Radio digital communications will be presented. They will cover communications via terrestrial, ionospheric, meteor-scatter and satellite media including AMSAT OSCAR 10 and PACSAT.

Topics addressed may include network and system architecture, proposed standards, hardware, software, protocols, modulation and encoding schemes, applications and practical experience. For further information contact Paul Rinaldo, W4RI, Technical Department Manager at ARRL HQ, 203-666-1541 or 225 Main Street, Newington, CT, 06111.

### Eastern VHF Conference Slated For New Hampshire

The 10th Annual Eastern VHF/UHF Conference will be held May 4-6, 1984, at the Sheraton Tara, Exit 1, U.S. Route 3, Nashua, New Hampshire. The program features a Friday night hospitality room, technical talks by well-known VHFers, "rap sessions" for the various VHF/UHF bands, noise figure and antenna measurements and other activities. To preregister, send $14,50 to Rick Commo, K1LOG, 3 Pryor Rd, Natick, MA, 01760 before April 29. Registration at the door is $20.00. The Saturday night banquet is $15.00 also payable before April 29.

Room reservations should be made directly with the Sheraton Tara Hotel, Nashua. A block of rooms has been reserved for the conference. Be certain to mention the "Eastern VHF/UHF Conference" to gain access to this reserved block of rooms.

Conference Chairman in Tom Kirby, W1EJ. Inquiries may be addressed to Lewis D. Collins, W1GXT, 10 Marshall Terrace, Wayland, MA, 01778. If you prefer you may telephone at 617-358-2854 before 10:00PM Eastern time, please.

### Manual Tracking Systems Popular

The Satellipse Phase III tracker by K2ZRO is selling well according to the inventor, Kaz Deskur. The manual tracking device provides accurate antenna pointing information together with an informative view of coverage areas, LOS, AOS times, etc. Kaz advises that he will provide a specially designed graph for anyone who sends an SASE to him. The graph provides the argument of perigee parameter if you know the latitude of apogee for AO-10. The Project OSCAR calendar provides an enumeration of all AO-10 apogees for 1984. It gives date and time as well as latitude and longitude of the apogee. Given the Project OSCAR calendar and the K2ZRO Satellipse, one has a complete AO-10 tracking package for the entire year. Project OSCAR will be inclosing the K2ZRO graph (latitude to argument of perigee converter) in all future mailings of the Project OSCAR Calendar. The calendar also contains the complete year's reference orbits for RS-5, 6, 7, and 8. The K2ZRO Satellipse is $10 postpaid North America to ZRO Technical Devices, P.O. Box 11, Endicott, N.Y., 13760. The Project OSCAR Calendar is available for $10 postpaid (North America) from Project OSCAR, P.O. Box 1136, Los Altos, CA, 94022. Both Project OSCAR and ZRO Technical Devices contribute directly to AMSAT. They deserve your support.

### AO-10 Glitch Tests Command Team

An unexpected glitch associated with the sun angle sent a chill through the AO-10 command team late in January. On Monday, 30 January VE1SAT noticed a very strange series of readings in the PSK telemetry. He notified several other team members who then instituted an international contingendy management team bridging three continents. Using electronic mail and the message forwarding capability of AO-10, the team was quickly able to ascertain that the problem had to do with the angle of the sun as seen by the sun sensors. There may have been some glint from one of the antennas or perhaps an uncharted internal reflection in the sun sensor. In any case the IHU (Integrated Housekeeping Unit) was "confused" by the glint and gave a series of anomalous readings leading to the alert by the command team. Most serious of the indications was one which pointed to serious BCR Battery Charge Regulator malfunction. Fortunately this and another bogey indication (the spin rate) were all artifacts of the odd sun sensor output. DJ4ZC quickly determined a fix (lowering sensor trigger threshold) and AO-10 was back in shape. The contingency team stood down and the spacecraft was back in order the next day none the worse for wear. This, the second unexpected glitch, was handled quickly and again demonstrated the tremendous versatility of both the spacecraft and the command structure (executed through the DJ4ZC-developed IPS language.). The prior contingency developed when certain software "fuses" tripped out on 30 Sep 83. (See *ASR* #64).

### GAS Can Controller Project Undertaken

AMSAT has agreed to supply the primary controller for a Space Shuttle GAS (Get-Away Special) experiment package. The GAS package is a community sponsored project in the Texas cities of El Paso and Ysleta. It contains 12 experiments mostly in the Biological sciences.

The experiment is the primary GAS package on STS 41-F, currently scheduled for launch August 9, 1984. This mission will be the second flight of Discovery, the third Orbiter in America's shuttle fleet.

your scribe in the hope that blocking might be reduced and a chance given to stations with appropriate power levels. Regretably, the band was full of QRO CQs of stations many of whom, it would seem, were running well in excess of 1 kW eirp. A power declaration, though not called for, was expected as always when using the RS satellites.

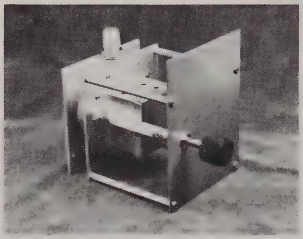
The W5LFL mission on STS-9 was a knock-out in Europe, creating the world's biggest ever pile up. Reception was complicated by a superb tropo opening, as well as incorrect information given out in Europe that resulted in a reversal of both uplinks and downlinks, and the odd/even minute procedure for calling and listening. Add to this early wrong orbital information resulting in people trying to give out correct info being told to QRT as he WAS on (when he was over the antipodeal point) and then chatting about why they did not hear him while he WAS actually on, and we had the ingredients for a revolution (not orbital)! Some stations could be heard calling him 24 hours per day (on his downlink frequency of course)!

Congratulations to G6RH, Bob, who by patient and tireless work over many years has finally achieved DXCC Satellite, only the second in Europe, using only the low orbiting satellites as stipulated in the ARRL rules.

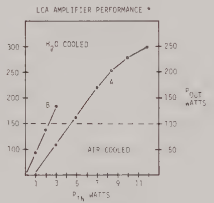
Finally, from the GM4IHJ software stable, comes a satellite program of value for those wishing to observe the effects of shadow and poor sun-angles on the battery charge, temperature, etc. "INSOL" gives both numerical and graph displays of various near-earth circular and elliptical orbital satellites, printing the UTC time, latitude and longitude of the sub-satellite point, the insolation angle at the satellite, and the great circle between the solar and satellite sub-points, with mean anomaly. It also gives the efficiency assuming earth-pointing antenna and whether the satellite goes into shadow. That, as with other of John's programs for the Spectrum computer, are now known to run on the Timex 2068 computer available in the USA, etc., and will be available from the AMSAT Software Exchange, N5AHD, by the time you read this.

Please keep your news, views, activities, findings, photographs and station news, listings, DX and propagational information coming in for future issues.

**Cavity Power Amplifier 1240 to 1300 MHz**



- Single 2C39/7289 tube.
- 50-ohm in & out; no stub tuner req'd.
- 250 watts maximum output.
- Tunes the entire band with front panel control.
- No exposed high voltage while tuning.
- Ptfe (Teflon) anode tuner, no moving metal parts.
- Convenient remote mounting.
- Silver plated 1/8th inch copper plates, heavy aluminum construction for thermal stability.
- Supplied with $H_2O$ cooling and bias switching information.
- Simple hybrid combining for higher output power.
- Over 16,000 hours of continuous operation to date.
- Adjustable output loading control.



* $E_p$ 1360V, Ig @ 250 W = 50 mA
$H_2O$ COOLING AT .3 GAL/MIN.
A - TUNED FOR POWER
B - TUNED FOR MAX GAIN

- Model LCA without tube . . . . . . . . $275
  Delivery 14 to 45 days.
- Screw on $H_2O$ jackets for 2C39/7289, anodized aluminum, with gasket. . $17

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- GaAsFET preamplifiers on any freq. up to 3 GHz. Guaranteed stability.
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Chip Angle, N6CA (LM 135)

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- **Amplifiers**
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- **Preamps**
  Lunar GaAsFET, regular or mast mount, 2m, 70cm
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  Astron 12 Vdc Models from 4A to 50A; metered and nonmetered

★ New ICOM IC-471A
all-mode 430-450 rig. Fantastic!

★ New ICOM IC-271A
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|---|---|---|---|---|---|---|
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| P50VD | 50-54 | <1.3 | 15 | 0 | DGFET | $29.95 |
| P50VDG | 50-54 | <0.5 | 24 | +12 | GaAsFET | $79.95 |
| P144VD | 144-148 | <1.5 | 15 | 0 | DGFET | $29.95 |
| P144VDA | 144-148 | <1.0 | 15 | 0 | DGFET | $37.95 |
| P144VDG | 144-148 | <0.5 | 24 | +12 | GaAsFET | $79.95 |
| P220VD | 220-225 | <1.8 | 15 | 0 | DGFET | $29.95 |
| P220VDA | 220-225 | <1.2 | 15 | 0 | DGFET | $37.95 |
| P220VDG | 220-225 | <0.5 | 20 | +12 | GaAsFET | $79.95 |
| P432VD | 420-450 | <1.8 | 15 | −20 | Bipolar | $32.95 |
| P432VDA | 420-450 | <1.1 | 17 | −20 | Bipolar | $49.95 |
| P432VDG | 420-450 | <0.5 | 16 | +12 | GaAsFET | $79.95 |
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| SP28VD | 28-30 | <1.2 | 15 | 0 | DGFET | $59.95 |
| SP50VD | 50-54 | <1.4 | 15 | 0 | DGFET | $59.95 |
| SP50VDG | 50-54 | <0.55 | 24 | +12 | GaAsFET | $109.95 |
| SP144VD | 144-148 | <1.6 | 15 | 0 | DGFET | $59.95 |
| SP144VDA | 144-148 | <1.1 | 15 | 0 | DGFET | $67.95 |
| SP144VDG | 144-148 | <0.55 | 24 | +12 | GaAsFET | $109.95 |
| SP220VD | 220-225 | <1.9 | 15 | 0 | DGFET | $59.95 |
| SP220VDA | 220-225 | <1.3 | 15 | 0 | DGFET | $67.95 |
| SP220VDG | 220-225 | <0.55 | 20 | +12 | GaAsFET | $109.95 |
| SP432VD | 420-450 | <1.9 | 15 | −20 | Bipolar | $62.95 |
| SP432VDA | 420-450 | <1.2 | 17 | −20 | Bipolar | $79.95 |
| SP432VDG | 420-450 | <0.55 | 16 | +12 | GaAsFET | $109.95 |

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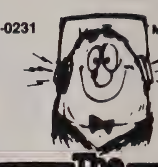

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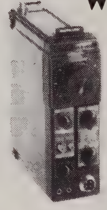

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# AMSAT News

(Continued from page 25)

### Bulletin Stations Revise Schedule, Freqs

The growing popularity of the W6CG/WYKAG bulletins on AO-10, Mode B has prompted continuation of the trial services provided by the duo. However, several changes will be manifest as the project enters its second phase.

Bud and Butch have advised *ASR* of several changes that will go into effect immediately. First, the bulletins will henceforth be transmitted only for orbits where the apogees fall between 120 and 180 degrees West. (Formerly 60 to 180). The bulletins will be sent from one hour prior to through one hour subsequent to these apogees as before.

Secondly, on Wednesday and Saturday, the Mode B bulletins will follow Mode L so look for the bulletins from 1 hour through 2 hours after apogee on these days.

Third, no Mode B bulletins will be transmitted on Mondays, QRP day. If you value these bulletins, please let us know. Write W6CG.

### New Area Coordinators Announced

Chief Area Coordinator W0CY announces the appointment of the following new area coordinators:

New York City (and environs)
Roger Soderman, KW2U

New Mexico
J.D. Miller, WA5WHN

Oregon
David Barnard, W7LSV

AMSAT congratulates these newest team members. Welcome aboard! Additional Area Coordinators are sought. Contacy W0CY, 1404 S. 10th St., Salina, KS 67401 or call (913) 827-2927.

### Dayton Hamvention Preparations In High Gear

The largest convention of its kind is rapidly approaching. Wray Dudley, W8GQW, reminds everyone that the weekend of 27, 28 and 29 April should be circled on your calendar. It is then that the mammoth event which is the Dayton Hamvention will be on-line.

The Hamvvention is always an important event in AMSAT's calendar too! AMSAT will be there with the largest contingent of any event throughout the year. The AMSAT booth is always busy and well-staffed with experts and friends to answer your questions; exchange views. And of course it's time to renew old friendships and make new ones as well.

AMSAT forums have been arranged for each of the three days. AMSAT officials will give presentations on a variety of subjects of great interest to all members and to participate in discussion periods. A special guest will be ZS6AKV, Hans, President of AMSAT SA. Hans is preparing talks on the balloon experiments performed by AMSAT SA and also on satellite operation for the beginner.

W8GQW lives in Troy, Ohio, not far from Dayton. Wray, along with K8OCL and W8JLE plays a key role in preparing for AMSAT's participation in this fantastic event, the Dayton Hamvention. Plan now to be among the hundreds of AMSAT members on hand. It won't be the same without *you*!

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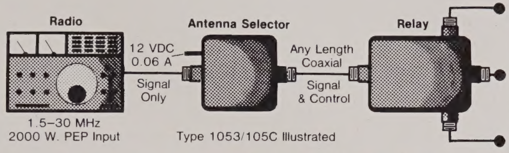
**Switch All Your Antennas Over One Coaxial Feedline**

With INLINE weatherproof coaxial relays you can add 2, 3, 6, or even 9 antennas without costly control cables. INLINE Relays take the guesswork out of point to point HF communications. By selection, you can instantly compare one antenna to another, switch monobanders, switch from horizontal to vertical, add WARC band antennas, create simple directable wire or vertical arrays, or whatever else you can dream up. On VHF-UHF you can significantly reduce hardline usage, eliminate tower-caused directivity, change polarization, change frequency, or switch antennas.

INLINE relays can be installed virtually anywhere without expensive and unsightly multiwire control cables. They can be placed in the attic, on the roof, on a mast, on a tree, on a tower, anywhere the antennas are.



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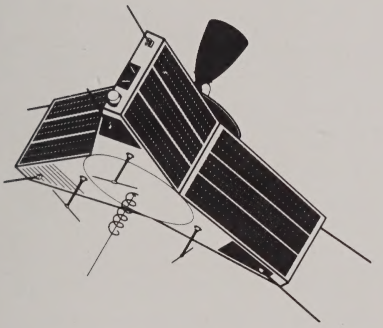

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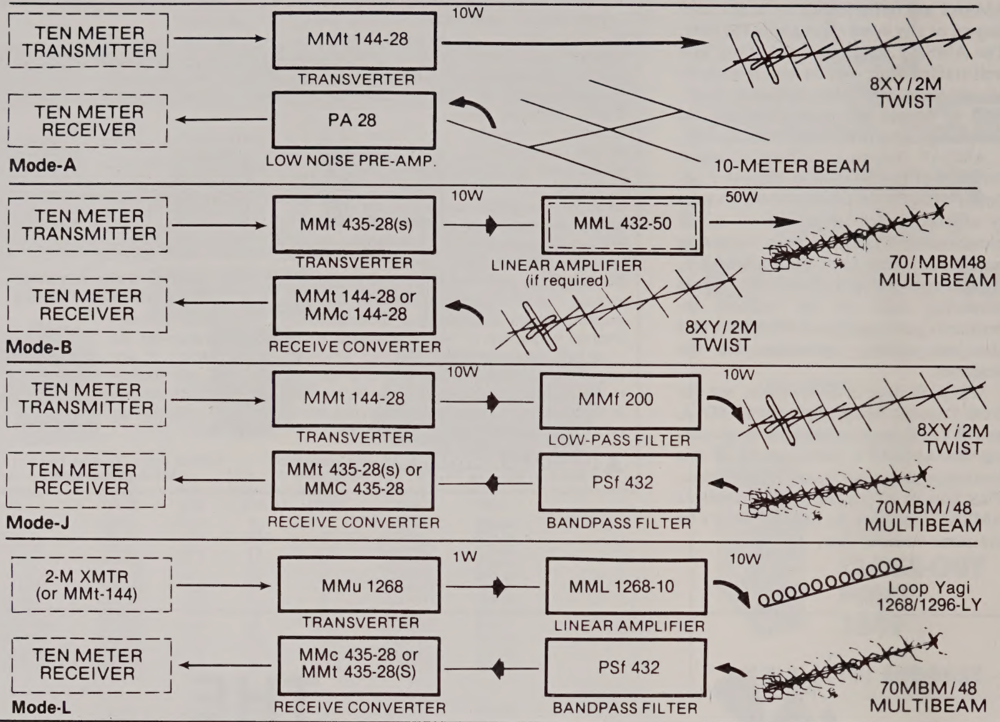
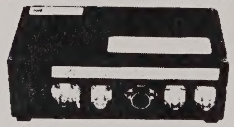
# OSCAR SYSTEMS FROM SPECTRUM INTERNATIONAL





## CONVERTERS AND TRANSVERTERS FOR

**OSCAR-8**
**UoSAT/OSCAR-9**
**OSCAR-10**
*(Phase III)*

***Specifications:***
Output Power: 10W
Receiver N.F. 3 dB Typ.
Receiver Gain: 30 dB Typ.
Prime Power: 12 Vdc

***Receive Converters:***
MMc 144 $59.95
MMc 435-28(s) $69.95
MMc 435-28(TC) $69.95

***UHF Filters:***
MMf 200-5 $31.95
MMf 200-7 $42.95
PSf 432 $74.95

Mod. kit to adapt original MMt 432-28 to Mode-J oper: $26.50

***AMSAT/OSCAR-10 Mode-L Equipment:***
Transverters: 3 Models - selection of 10, 6, 2-meter i-fs.
Transmit only converters: 2 Models - sel. of 10, 6, 2-meter i-fs.
Receive only converters: 3 Models - sel. of 10, 6, 2-meter i-fs.
Antennas: Loop-Yagis, single, twin and quad stacking.
Tx Power Amps (Transistor): 3 Models, ½W/1W input; 8W, 10W, 17W output.

Attention owners of the original MMt 432-28 models: Update your transverter to operate OSCAR-8 and AMSAT/OSCAR-10 (Phase III) by adding 435-to-437 MHz range. Mod. kit including full instructions is $26.50 plus $1.50 shipping.

## ANTENNAS

| | |
|---|---|
| 2-Meter 8 + 8 twist Model 8XY/2M | $62.40 |
| Phasing Harness Model PMH/2C | $13.35 |
| 48 el. 70 cm Multibeam Model 70-MBM-48 | 75.75 |
| 88 el. 70 cm Multibeam Model 70-MBM-88 | $105.50 |

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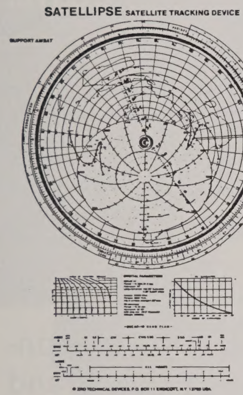
OSCAR-10/RS Satellite-Tracking Calculator Kit, as described in *ORBIT* Magazine, but with many additional features.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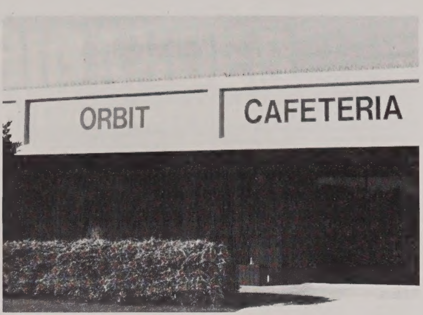

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***Now with GaAs FET Preamp***

- Linear (all mode) RF power amp with automatic T/R switching (adjustable delay)
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| 1410<br>1410G | 144 | 160 | 10 | 225<br>265 |
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| 2212<br>2212G | 220 | 130 | 30 | 199<br>239 |
| 4410<br>4410G | 440 | 100 | 10 | 225<br>265 |
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1. Models with G suffix have GaAs FET preamps. Non-G suffix units have no preamp.
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## TR-9500

### 70 CM SSB/CW/FM transceiver

- Covers 430-440 MHz, in steps of 100-Hz, 1-kHz, 5-kHz, 25-kHz or 1-MHz.
- CW-FM Hi—10 W, Low—1 W. SSB 10 W.
- Automatic band/memory scan. Search of selected 10-kHz segments on SSB/CW.
- 6 memory channels.

## TR-9130

### All mode (FM/SSB/CW) 25 watts, plus...!!!

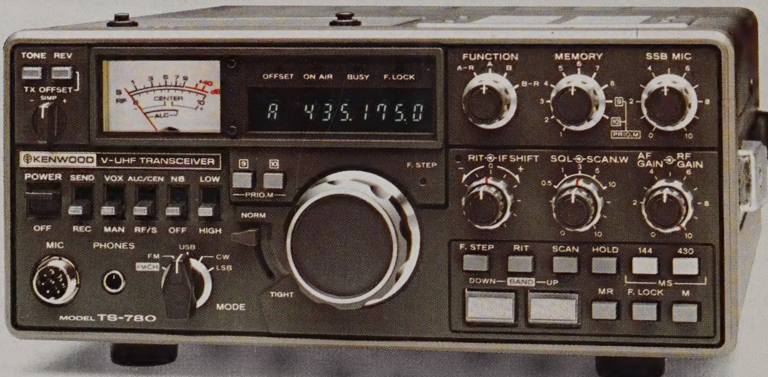
**The TR-9130 is a powerful, yet compact, 25 watt FM/USB/LSB/CW transceiver. Available with a 16-key autopatch UP/DOWN microphone (MC-46), or a basic UP/DOWN microphone.**

**TR-9130 FEATURES:**

- 25 Watts RF output on all modes, (FM/SSB/CW).
- FM/USB/LSB/CW all mode. Selectable tuning steps of 100-Hz, 1-kHz, 5-kHz, 10-kHz.
- Six memories. On FM, memories 1-5 for simplex or ±600 kHz offset, using OFFSET switch, Memory 6 for non-standard offset. All six memories may be simplex, any mode.
- Memory scan.
- Internal battery memory back-up, using 9 V Ni-Cd battery, (not KENWOOD supplied). Memories are retained approx. 24 hours, adequate for the typical move from base to mobile. External back-up terminal on the rear.
- Automatic band scan.
- Dual digital VFO's.
- Transmit frequency tuning for OSCAR operations.
- Squelch circuit for FM/SSB/CW.
- Repeater reverse switch.
- Tone switch.
- CW semi break-in; sidetone.
- Compact size and lightweight.
- Covers 143.9 to 148.9999 MHz.
- High performance noise blanker.
- HI/LOW power switch. 25 or 5 watts on FM or CW.
- RF gain control. • RT circuit.

**Optional accessories:**

- KPS-7A AC power supply.
- PS-20 AC power supply (TR-9500 only).
- BO-9A system base with memory back-up supply.
- SP-120 external speaker.
- TK-1 AC adapter for memory back-up.



## TS-780

### All mode "Dual-Bander"...2-m & 70-cm all mode, dual digital VFO's, 10 memories, scan, IF shift...

**TS-780 FEATURES:**

- USB, LSB, CW, FM all mode, covering the 2-m band (144.000-148.000 MHz) and the middle 70-cm band (430.000-440.000 MHz). UP/DOWN band switch.
- Dual digital VFO's with normal/tight drag switch. VFO steps in 20-Hz, 200-Hz, 5-kHz, or 12.5-kHz, plus "FM CH" channelized tuning. Split (cross) frequency operation possible. F. LOCK switch provided.
- 10 memories include band and frequency data, backed up by internal batteries (not supplied). Battery life exceeds one year. Memories 9 and 10 for priority instant recall.
- Band scan, with selectable 0.5, 1, 3, 5, and 10-MHz scan bandwidth.
- Memory scan selectable for all memories, or 2-m or 70-cm only.
- IF shift circuit rejects adjacent interference.
- High sensitivity and wide dynamic range.
- 7-digit fluorescent tube digital display.
- 10 watt RF output.
- 2-m ±600-kHz TX offset switch with reverse switch.
- Tone switch for optional TU-4C programmable two-frequency CTCSS encoder unit.
- VOX and semi break-in CW built-in.
- FM center-tune meter.
- Noise blanker for SSB, CW.

**TS-780 accessories:**

- **TU-4C** programmable two-frequency CTCSS encoder.
- **MC-42S** 500 Ω UP/DOWN hand microphone.
- **MC-48** 16-button Autopatch UP/DOWN microphone.
- **MC-60A** deluxe desk top microphone.
- **MC-80** desk top UP/DOWN microphone.
- **TK-1** AC adaptor for memory back-up.

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